APRIL · 1954

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING



Chicago contractors', wiring display invites consultation on wiring problems.

Page 86



Research and development plant substation, served by 4800 volts, planned for future 13.2 kv.

Page 63

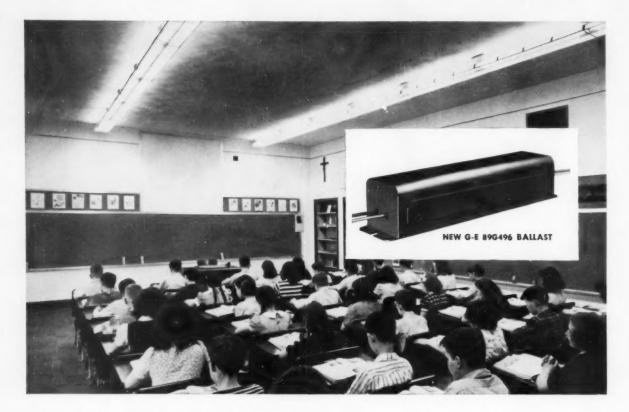


Fort Worth airport is served by modern electrical system design.

Page 88

The Electrical
Contractor's
Stake in
Air Conditioning
- a special report

A McGRAW-HILL PUBLICATION 53 RD YEAR



New G-E Ballast for 96T12 Lamps

QUIETER, SMALLER, LIGHTER

The new G-E ballast for 96T12 lamps has been redesigned so that it is now shorter, lighter and quieter. Yes, quieter. Now for the first time General Electric offers you a ballast for 96T12 lamps that has a "D" sound rating. This lower noise level makes operation possible in a variety of new applications. Fixtures equipped with this new G-E ballast are now suitable for schools, hospitals, libraries and many other installations where noise is a problem.

The new ballost is only $11\frac{3}{4}$ inches long. The shorter length— $3\frac{1}{8}$ inches less than the old design—means reduced handling and storage problems for you.

This new series ballast weighs only $10\frac{1}{2}$ pounds—a reduction of $1\frac{3}{4}$ pounds over the old design. This means savings in shipping costs for both manufacturer and distributors.

By redesigning, this ballast has been changed from

an "E" to a "D" sound rating. Manufacturers can now use this new G-E series ballast in fixtures installed in many low-noise areas.

For further information on sound rating and G-E ballasts send the coupon below to General Electric Company, Schenectady 5, N. Y.

Section B 401-5
General Electric Company
Schenectady 5, N. Y.
Please send me new bulletin GEA-5672, "How to put Sound Rating to Work."
Name
Position
Company
Address

Progress is our most important product

GENERAL E ELECTRIC



You need U. S. GRIZZLY Uskorona-insulated Power Cables

Here's an illustration showing how ozone can chew up a sturdy, rugged cable. This can never happen with United States Rubber Company's famous Grizzly® Power Cables insulated with Uskorona® compound which prevents electrical failure caused by ozone (Uskorona-1 oil base compound or Uskorona-2 butyl rubber compound). Uskorona meets (and in many ways exceeds) the applicable IPCEA specifications for ozone-resistant rubber insulation.

As the only wire manufacturer that grows its own natural



U. S. Grizzly Uskorona-insulated Power Cable, 5,000 Volts, type RR 3 conductor, shielded, Neoprene jacket.

rubber, produces its own synthetics and makes its own plastics (as well as the bulk of its own rubber-compounding chemicals and ingredients), United States Rubber Company is able to make certain that only the finest materials are used in the insulations for its wires and cables. These materials are expertly compounded according to methods devised after years of research and experimentation in "U.S." laboratories. Finally, U.S. Rubber's practical "know-how" contributes its important part to the uniform high quality of every "U.S." insulation. This "know-how" is the result of 68 years of successful manufacture of electrical wires and cables, and over a century in the making of fine rubber products.



Send for free catalog giving full information about U. S. Electrical Wires and Cables

UNITED STATES RUBBER COMPANY

ELECTRICAL WIRE & CABLE DEPARTMENT ROCKEFELLER CENTER, NEW YORK 20. N. Y.

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1954



Relamp or Convert to Higher Wattages in SECONDS...

APPLETON

September 1988

Explosion-Proof
Fixtures







Note how identical diameters "A" at top of Dome Unit Assembly permit mounting of all fixtures regardless of wattage.

58 SECOND RELAMPING



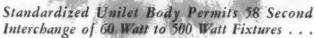
When the call comes for relamping, AA-51 Series STAND-BY Units are ready at an instant's notice. Carrying handles can be attached in advance.



Maintenance man needs only a screw driver to exchange units. From the time of climbing the ladder to exchanging fixture and descending ladder, only 58 seconds are required.



Burned out lamps and cleaning fixture are safely attended to at the work bench, while production schedules are maintained.



Saves Time, Prevents Shutdowns! All of your customers, in whose plants there are hazardous areas, will appreciate you telling them about Appleton AA-51 Series Vented Explosion-Proof Fixtures.

No other similar units have so many exclusive features . . . offer so much. In fact, less efficient units now in use cost your customers real money, in many ways, each day they remain in service.

Appleton AA-51 Series meet all Underwriters' Laboratories requirements for Class I, Groups C and D Hazardous Locations.

Here is a genuine profit opportunity for you! Write for Full Details, Today!

- "FLAME-TIGHT" CONTACT CHAMBER
 Because of Appleton's exclusive "5-Thread Safety Chamber"
 any AA-51 Series Unit can be serviced with complete safety
 even if current is inadvertently left on!
- "FULL-CIRCLE" VENTING
 The notched globe ring and the porous metal interior dissipate heat evenly and safely and keep fixture temperature cool enough to prevent igniting explosive gases.
- "STAND-BY" SYSTEM SAVES MONEY
 For every ten AA-51 Units in peration Appleton recommends one unit as a stand-by... ready for relamping or wattage conversion in 38 seconds.

SOLD THROUGH ELECTRICAL WHOLESALERS

APPLETON ELECTRIC COMPANY

1704 Wellington Avenue • Chicago 13, Illinais





Also Manufacturers of





Outlet Boxes

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting. The Electrogist and Electrical Record Established 1901

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

53rd Year APRIL • 1954

Washington Report	57
At a Glance	59
Do-It-Yourself Crisis, An Editorial	61
Distribution for Development	63
By R. C. HODGES—Plug-in, trolley and underfloor duct, 50 footcandles of general illumination, extensive grounding, relay controls, low-voltage switching and high cycle motors are features of Marlin-Rockwell's new plant at Falconer, N.Y.	03
3-Man Crew Maintains School Lighting	68
Birmingham's 86 schools are lighted to a lighting level of more than 30 footcandles by 60,000 fluorescent lamps in continuous row louvered luminaires.	
What's in Air Conditioning for Electrical Contractors	69
A special editorial report on the electrical contractor's role in air conditioning with a guide to operation, application, installation and maintenance of air conditioning systems.	~
Contractors' Wiring Display and Clinic Pay Off	86
Booth to remain as permanent exhibit in Edison Company building in Chicago.	
Wiring A Modern Airport	88
By FRED R. SCHMIDT—A roundup of details on wiring design, equipment layout and installation methods of the electrical system at the Greater Fort Worth International Airport.	
Key to Long Range Modernization	91
By H. P. SCOTT—Modernization was obtained by installing dual primary and secondary feeders, revamping substations, balancing electrical loads on circuits, installing modern switchgear, increasing illumination levels, installing plug-in duct and capacitors.	
Commercial High-Voltage Installation, Part I	94
By D. L. BEEMAN and H. D. KURT—Some convincing arguments for high- voltage distribution in commercial structures, and some specific economic	



ELECTRICAL CONSTRUCTION and MAINTENANCE

APRIL . 1954 continued

Data Sheet	98
Practical Methods	167
Foreman's record kit speeds field paper work; aluminum troughs promote wiring flexibility; 5-minutes per hole with a diamond core bit.	
Motor Shops	174
Lathe and geared rollers used to wind spools; shop- made balancer has simple construction; coils pulled with cam-operated tongs.	
Reader Service	183
Reader's Quiz Ouestions and answers on constant current trans-	213
formers; transient voltage; underground distribution system; testing motors.	
Questions on the Code	219
Answers to code questions including underground service; multi-wire branch circuits; circuits for projectors; signal lights in operating rooms.	
Modern Lighting General and local lighting for Chicago service station; recipe for light cooking; modern lighting in home for aged.	231
In the News	239
Dates Ahead	248

W. T. STUART, Editor

Alice McMullen, Associate Editor

Berlon C. Cooper, Eastern Editor

August Eckel, Middle West Editor

Hugh P. Scott, Industrial Editor

J. F. McPartland, Jr., Assistant Editor

W. J. Novak, Assistant Editor

John P. Reynolds, Assistant Editor

Harry Phillips, Art Editor

W. A. Cyr, Pacific Coast Editor

Ray Ashley, B. A. McDonald, Walter J. Prise, Glenn Rowell, B. Z. Segall, Consulting Editors

Dexter Keezer, Dir. Economic Staff

George B. Bryant, Jr., Chief Correspondent, Washington Bureau

Joseph K. Van Denburg, Jr., Editor, World News

W. W. GAREY, Publisher

District Managers

A. B. Conklin, New York

S. A. Jones, New York

L. S. Kelley, Jr., Philadelphia

F. J. Seiler, Cleveland

Charles F. Minor, Jr., Chicago

R. R. Ream, Chicago

T. H. Carmody, San Francisco

C. W. Dysinger, Los Angeles

J. H. Cash, Dallas

R. H. Sidur, Atlanta

AUDIT BUREAU OF CIRCULATIONS and ASSOCIATED BUSINESS PUBLICATIONS

Vol. 53, No. 4

ELECTRICAL CONSTRUCTION and MAINTENANCE

April 1954

Published monthly with an additional issue in September by McGraw-Hill Publishing Company Int. James H. McGraw (1880-1948), Founder. Publication Office, 59-129 North Broadway, Albany 1, R.Y.
Essextive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New Yark Ss., R. Y. Donald C. McGraw, President; Hillard Cheveller, Essextive Vice-President; Joseph A. Gerardi, Vice-President and Trassurer; John J. Conke, Secretary; Paul Mondgomeny, Sanie Vice-President, Publications Division: Rajob B. Smith, Vice-President and Establish School, Vice-P

Subscription Service, 99-129 N. Bway, Albany I, N.Y. or 330 W. 42nd St., New York 35, N.Y. Allow one month for change of address.

Subscriptions are solicited only from persons engaged in electrical construction or electrical maintenance. Position and company connection must be indicated on subscription orders. Single copies 35c. Electrical Products Guide \$2.50 to those in the electrical construction and maintenance industry. Subscription and. ampar opinis 36. Learner Products units \$2.50 to trave in the electrical construction and maintenance industry. Subscription rate—United States and possessions, \$3.00 a year; \$4.00 for two years. Chande, \$5.00 a year; \$6.00 for two years. Chande, \$5.00 for two years. All other countries, \$15.00 a year. Entered as second class on year; \$15.00 for two years. All other countries, \$15.00 a year. Entered as second class matter August 27, 338, at the Post Office at Albany, \$7.4, unider act of Mar. 3, \$279, Prinhedia U.S.A. Copyright 1954 by McGraw-Hill Publishing Co., 1sc.—All Rights Reserved.

-special-industry enclosure!

Patterned after Joint Industrial Control requirements

New I-T-E particle-proof enclosure assures dependable circuit breaker operation in all dust-laden atmospheres:

EXTERNAL MOUNTING FEET

Readily accessible, for easy surface mounting.

DUST-TIGHT ENCLOSURE

Solid sheet-steel sides and back with closed welded seams. No holes—no knockouts. Attractive bonderized finish.

EXTERNAL OPERATING HANDLE

New molded handle operates circuit breaker from outside enclosure. Plate indicates position of breaker handle at all times. Handle may be padlocked in either "ON" or "OFF" position. Defeater arrangement allows authorized personnel to open cover with breaker "ON."

DOUBLE-LOCKING COVER ARRANGEMENT

FELT COVER-GASKET

Recessed and held in place by metal retaining strips. Assures tight seal when cover is shut.

DEFENDABLE 1-T-E MOLDED CASE CIRCUIT BREAKER

Thermal-magnetic. Provides positive protection against short circuits and overcurrents. Quick-make, quick-break, trip-free. Assures quick restoration of service without replacement of elements. I-T-E quality design and construction.

AVAILABLE NOW

with I-T-E "E" frame, "F" frame, "J" frame, and "L" frame circuit breakers—in ratings from:

> 15-600 amperes 125-600 volts a-c 125-250 volts d-c

SEE YOUR LOCAL I-T-E REPRESENTATIVE OR DISTRIBUTOR

or write to 1-T-E Circuit Breaker Co., 19th and Hamilton Sts., Phila. 30, Pa.



CONDULETS* are they're made right



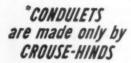
Type LB Obround Condulet



Type FS Threaded, With Pilot Lamp Receptacle, Switch, and Plug Receptacle



Type EPC Explosion-Proof Motor Starter and Circuit Breaker Condulet









Six-spindle automatic screw machine performs six operations simultaneously — makes dozens of hub reducers or conduit union parts every minute.

Crouse-Hinds modern methods produce a superior product . . . to serve you better

Crouse-Hinds factory is equipped with the finest modern machinery, designed for fast, accurate production. To turn out the quality work of which they are capable, such machines require expert handling. Crouse-Hinds machinists have the skill that can come only from long years of careful workmanship. A high percentage have more than twenty-five years of loyal service to their credit. These highly trained machine operators are producing a superior product . . . to serve you better.

More than 15,000 types and sizes of Condulets are listed in the Condulet Catalog . . . a type for every purpose in hazardous and non-hazardous locations.

Always specify Condulets and get the benefit of Crouse-Hinds quality on every job.

When quality counts . . . you can count on Condulets*

CROUSE-HINDS COMPANY Syracuse 1, N. Y.

OFFICES Birmingham - Boston - Budish - Chlooge - Circinanti - Circeland - Dullon - Dancer - Dates) - Buston - Budisangoliu - Ennos City - Les Angels Milwocker - Hew Orions - Pew Ford - Briotologhia - Brinsburgh - Portand Over - San Francisco - Baesthe - Rickein - Rivel - Table - Westington.

RESIBENT REPRESENTATIVES: Albuay - Adianta - Boltimore - Charlotte - Corpus Christi - Bredding Po. - Richmond. Vo. - Skrewsport

CONDULETS

TRAFFIC SIGNALS

tops in quality to last longer



One machinist operates two semi-automatic tapping machines, each of which threads four Condulet hubs simultaneously to insure perfect alignment of the final conduit installation.



Pneumatic wrench is adjusted to provide exactly right amount of torque to fasten globes rapidly and securely into globe holders for explosion-proof lighting fixtures.



Type EVA Explosion-Proof Lighting Fixture



Type FLF Explosion-Proof Manual Motor Starting Switch Condulet



Type ARE Plug Receptacle With Spring Door



Type LBH Explosion-Proof Condulet For Pulling Cable

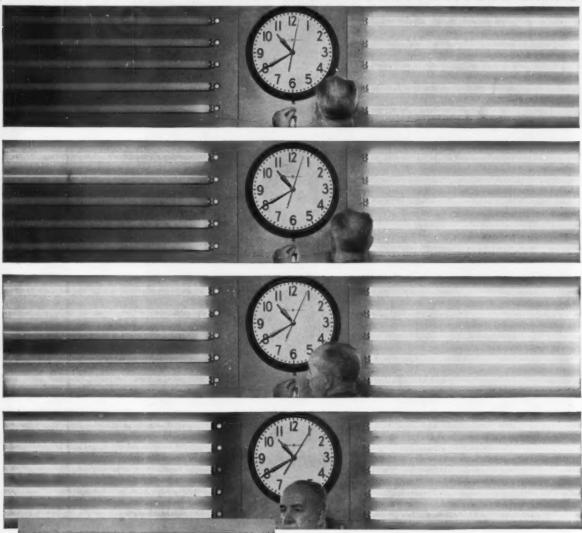


Type GUAC Explosion-Proof Junction Condulet

FLOODLIGHTS

AIRPORT LIGHTING

YOU EXPECT THE BEST VALUE FROM G-E FLUORESCENT LAMPS



New G-E"Rapid Start" lamps light up twice as fast as others



This series of pictures shows how General Electric can save you the annoyance of waiting for light.

All the lamps were started as the second hand on the clock reached zero. Within two seconds, the G-E Rapid Start lamps—right of the clock—were fully lighted. It was nearly six seconds before all the regular lamps, left, lit up.

G-E Rapid Start lamps eliminate the starter, cause of up to half of regular lighting maintenance troubles. They have long life, too. Reason: a triple-coil cathode that holds more starting chemical.

General Electric Rapid Starts are another example of why you can *expect* the best value from G-E fluorescent lamps. For free folder, "Facts About Rapid Start", write: General Electric, Dept. 166-EC-4, Nela Park, Cleveland, O.

You can put your confidence in-

GENERAL 🚳 ELECTRIC



How Metalclad Switchgear

PAYS FOR ITSELF IN HALF THE

at the University of Louisville

THE University of Louisville recently completed the initial phases of modernizing its electrical system. This program provided for replacing six 110/220-volt metering stations with a high-voltage switching center where the incoming service is metered at 13.5 kv. The University is now saving at the rate of several thousands of dollars annually in electric power costs—and as projected additional loads are added, the annual savings will be still further increased.

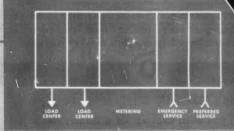
The low initial cost of S&C Metalclad Switchgear—used for this new switching center—makes it possible for these annual savings to pay for the switching center very quickly.

Don't let your plans for modernization or new construction crystallize without first finding out whether S&C Metalclad Switchgear can provide the protection and switching you need. Information about S&C Metalclad Switchgear is contained in this booklet . . . send for a free copy ... yours for the asking.

Mr. R. S. PURVIS, Superintendent



of Buildings and Grounds for the University, proposed the modernization of the University's electrical system. He said, "We chose S&C Metalclad Switchgear because of its low initial cost, its safety, and the fact that it is very easy to add to when additional loads require it."



THE UNIVERSITY OF LOUISVILLE switching center provides (1) manual switching on preferred and emergency circuits, (2) metering of the 13.5 kv service, (3) protection and switching of feeders which supply outlying load centers from which 110/208-volt lighting and power service is provided to surrounding areas.

S&C Electric Company 4433 Ravenswood Ave., Chicago 40, Illinois

Please send me your new booklet on S&C Metalclad Switchgear. No obligation on my part, of course.

Title.

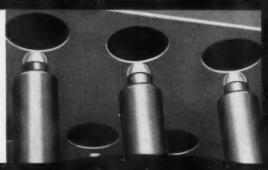
Company_ Address City_

Zone_State

4 reasons why G-E vertical-lift design is best for metal-clad switchgear

Allows you to see breaker disconnect

With General Electric's vertical-lift breaker, you can actually see that the circuit breaker is disconnected. You don't need to depend on an indicator and when the breaker is disconnected, mechanically operated shutters in metal-clad switchgear automatically close off these stationary disconnect openings to protect the operator.



Simple to inspect and maintain

While G-E breaker is still in the compartment, you can make most check tests and even perform some maintenance. Although removal of breaker element is relatively easy, inspection in the compartment saves considerable time and effort.



Saves time and energy

In G.E.'s vertical lift design air circuit breakers rated 100 MVA and larger are lowered and raised effortlessly by a simple, fast-acting elevating mechanism, consisting of two jack screws and a sturdy, compact gear-motor. You do away with jacking and cranking. Just set switch for "raise" or "lower" and hold clutch lever forward until breaker is in position.



Assures maximum safety

When you need to work on a feeder, you want to be sure that the breaker is disconnected. With G-E vertical lift, you can lower breaker until you see contacts disconnect, padlock the mechanism so breaker cannot be raised, and close compartment door. You can then work without fear that someone will carelessly close the breaker and energize the feeder. General Electric Company, Schenectady 5, N. Y. 511-1



Progress is our most important product

GENERAL (%) ELECTRIC

EASY ACCESS

Saves Installation Time!

You get plenty of room for making connections on Allis-Chalmers dry-type transformers. As the photo above shows, a removable plate at the front bottom of the case makes it easy to pull wires out and make connections. This feature is available on single-phase units 10 kva and below and three-phase units 15 kva and below.

For the higher ratings, you can remove the top cover to get equally easy access to connections. In addition, solderless clamptype connectors are available on single-phase sizes 15 to 50 kva inclusive, three-phase sizes 45 to 112½ kva inclusive.

Compact design helps simplify installation too. Allis-Chalmers dry-type transformers are light weight. They take little space. You can mount them anywhere — on walls, beams, or right on the machine they serve. Their all-welded cases give complete protection. No need for vaults or enclosures.

Get all the facts by calling your nearby Allis-Chalmers district office or authorized distributor. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.



DESIGN ARRANGEMENTS

KVA SIZES		MOUNTING	
SINGLE PHASE	THREE PHASE	ARRANGEMENT	TERMINATIONS
3 5 10	9 15	WALL MOUNTING LUGS	BOTTOM TERMINAL COMPARTMENT WITH REMOVABLE FRONT PLATE
15 25	30	WALL MOUNTING LUGS AND BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER
37½ 50 75 100	45 75 112½ 150 225 300	BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER

ALLIS-CHALMERS



IMPORTANT NEWS!

FOR CONTRACTORS

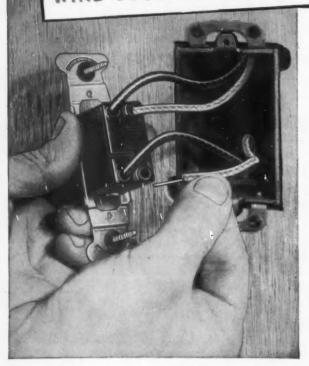
ARROW AH HART

NOW OFFERS

INTERCHANGEABLE and Junior Uiette

WITH SCREWLESS WIRE-LOCK TERMINALS

WIRE-LOCK TERMINALS SAVE TIME and MONEY!



EASY TO WIRE

Both the JUNIOR and the INTERCHANGEABLE QUIETTE SWITCHES are equipped with Arrow-Hart's screwless WIRE-LOCK terminals to speed up your jobs and save you time and money. Just strip off insulation to the length shown on the gage, insert the conductor into the terminal hole in the back of the switch . . . and that's all. The wire is securely locked in for a positive electrical and strong mechanical connection.

EASY TO RELEASE

RELEASE IS EASY WITH

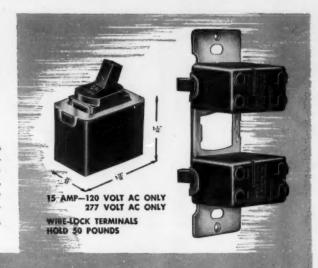
The "Key To Profit" or a small screwdriver depresses the clamp spring and unlocks the conductor for quick release. No time-consuming looping of heavy wires, no splicing, no soldering or taping.





The small, compact INTERCHANGEABLE QUIETTE SWITCH saves time, material, money. Screwless WIRE-LOCK terminals cut installation time, eliminate looping of wires. A special line feed thru shunt in single pole models means no extra wires needed; soldering, splicing and taping eliminated. It's rated at 277 volts to handle highly inductive load characteristics of fluorescent lighting jobs.

NO NEED TO DERATE THIS INTERCHANGEABLE SWITCH that gives quiet, mechanical operation.



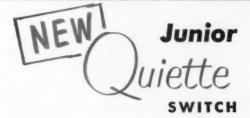
- Single or Double Pole, 3-Way or 4-Way
- Brown or Ivorylite

8

*

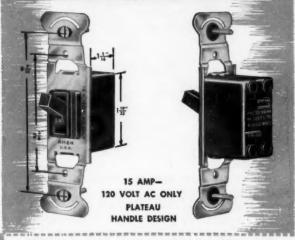
- Continuous Operation in any Position
- Positive Electrical Connections
- Quick Easy Wiring Easy Wire Release

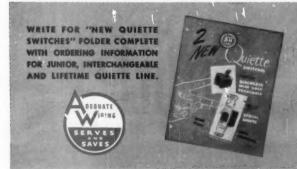
- No Mercury or other fluids
- Silver Alloy Contacts
- Strong Mechanical Connections
- Takes No. 14 or No. 12 Wire
- Underwriters' Laboratories Approved



The JUNIOR QUIETTE SWITCH for residential use in homes — and motels — is designed for users and contractors. Each job's more profitable because each job goes faster. Compactness gives more working room; WIRE-LOCK terminals and box screws supported in base plate by fibre washers save installation time. Your customers will like the quiet operation of the JUNIOR QUIETTE SWITCH and the "plateau" handle design that gives beauty to their homes and keeps out dust by fitting snugly into wallplate opening.

A ground feed thru shunt in single pole models saves you splicing, soldering and taping.







THE ARROW-HART & HEGEMAN ELECTRIC CO.

103 HAVYTHORN STREET, HARTFORD 6, CONN., U.S.A.

Please send me the following:

"NEW QUIETTE SWITCH" Folder.

CITY	ZONE	STATE	ECN
CO. ADDRESS			
COMPANY			-
POSITION			
NAME			

3 - Littings

THE ORIGINAL INDENTER TYPE E.M.T. COUPLINGS AND CONNECTORS

Briegel, the Original Indenter Fittings are neater in appearance, easier and faster to use. Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job.

All B-M Indenter Fittings are U. L. approved as Concretetight and for General Use. (File Card E 10863)



BRIEGEL METHOD TOOL CO.

Warehouse Stocks in Principal Cities for Immediate Delivery!



Stab-lok WILL HELP YOU SELL BUILDERS

because it has TOP acceptance

STAB-LOK® CIRCUIT BREAKERS give you all the winning arguments when you talk with builders. First of all, it's been proved that modern circuit protection is a real sales feature with prospective home buyers, and Stab-lok provides this at almost no extra cost. In the next place, there's no question about Stab-lok dependability. More Stab-loks are sold today than all other circuit breakers combined ... they're cn the job in literally millions of homes.

In addition, only Stab-lok gives you these extra advantages: Lowest cost—Across-the-board, Stab-lok costs less in the first place; costs less to install; costs less when circuits are changed or added.

Most complete line-You can't find a sensible specifica-

tion for circuit breaker protection that Stab-lok can't meet with speed and ease.

Most flexible - Stab-lok Magic "E", sequenced bussing, standard NA and space-saver NC breakers provide unheard-of flexibility.

Most distributors - Stab-lok distribution is unequalled; breakers and enclosures are available for prompt delivery the country over.

Builders are the biggest prospects for Stab-lok sales in your vicinity. Make the most of this opportunity...and write for the Magic "E" booklet which gives all the latest Stab-lok facts. Federal Electric Products Company, 50 Paris Street, Newark 5, New Jersey.



FEDERAL PACIFIC

ELECTRIC PRODUCTS COMPANY

ELECTRIC MANUFACTURING CORP

Federal products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct — Pacific Electric products: High voltage circuit breakers and power switches * Sales offices in principal cities.

The green light all the way with..

ACCURATE

– for easier, faster surer taping jobs!

ACCURATE is the choice for every electrical application. For regular wiring or heavy duty insulation, ACCURATE Standard and Specification Grades exceed required standards. Made of the finest raw materials, carefully compounded by tape specialists, every foot of Accurate Tape is inspected and tested by methods proved by experience gained in 30 years of tape manufacture. Specify ACCURATE for positive electrical and mechanical protection.



ACCURATE FRICTION TAPE

High grade carefully compounded rubber with finest cotton base provides maximum mechanical protection. Standard and A.S.T.M. grades.



ACCURATE RUBBER TAPE

Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M. — A.A.R. grades.



ACCURATE PLASTIC TAPE

Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

NEW TAPE CATALOG! The handy guide to tape selection for contractors, electricians, maintenance engineers and purchasing agents. Call or write for your copies today.

Accurate Mfg. Company, Garfield, New Jersey.



YOUR BEST BUY IN TAPE

MORE THAN A QUARTER

CENTURY OF TAPE SPECIALIZATION

NEW

light-weight generator



with

power

THIS NEW WINCO PLANT WEIGHS ONLY 148 LBS!

It is easily carried to wherever power is needed, and you can get full continuous power and top voltage regulation—more power per pound.

Two models available to meet your carryable power requirements. Model F-2500 DC and Model F-3000 AC. Choose either a Wisconsin AKN or Briggs & Stratton #14—both standard engines . . . parts stocks and fast service readily available.

New lightweight, new full power, plus Winco's job-proven "Economy Engineering" add up to the ideal carryable generator for lights and power tools.

F-2500 DC

2500 watts starting capacity and continuous output*—16.8 watts per pound with Wisconsin AKN.
2000 watts continuous output*
—13.5 watts per pound with Briggs & Stratten #14. Compound winding for full, SUPERCHARGED power when you need it.



F-3000 AC

2000 watts continuous output®, bonus motor starting capacity of 3000 watts®, 115V single phase, 60 cycle—13.5 watts per poundl Provides power for a greater number of tools. Serves as emergency stand-by power, too.



*Ratings determined at sea level and 60° F, ambient temperature. Write Wincharger for ratings at higher temperatures and/or altitudes.

Get all these Winco advantages

Superior Belted Construction. Permits engine to operate at manufacturer's recommended speed... assures smooth operation.
Belt adjusted in seconds.

Easily Serviced. Since engine and generator are independent, either one can be removed for service without dismantling the other.



USE WINCO'S NEW CARRYABLE SUPERCHARGED
ELECTRIC POWER FOR THESE AND
MANY OTHER USES.

ate C

Electrical Construction -





Multiple Use Control Panel. Four 115V, two-wire, twistlock receptacles . . . use four separate tools



Lubricated for life. Grease-sealed ball bearings eliminate the need of lubricating the generator.



Easy-to-start
4-cycle engines.
Proved, dependable
performance. Every
engine performance tested.





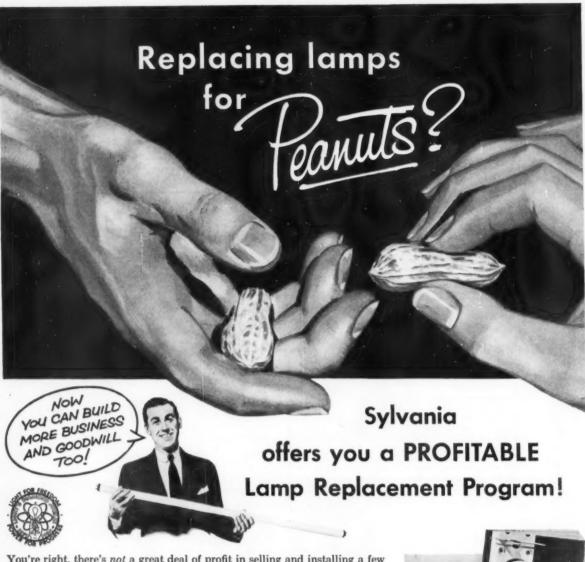
SEND THIS COUPON to Wincharger Corp., Sioux City, Iowa.

Send me complete information on Winco's new lightweight carryable generators.

Name____

Address

____State_



You're right, there's not a great deal of profit in selling and installing a few fluorescent lamps at a time. BUT, there's a whale of a good profit in replacing 500... or 1,000!

You get this "Plus Lamp Business" with the Sylvania Fluorescent Lamp Group Replacement Program.

By this plan you replace a customer's fluorescent lamps as a group . . . before burnouts become an expensive nuisance. This method saves him maintenance and labor costs, and reduces costly work interruptions. And, it assures better light for better production, better morale and appearance.

New illustrated booklet explains exactly how and why this Sylvania plan can build extra profits and good-will for you. For your copy address Dept. 4L-2404, Sylvania today!

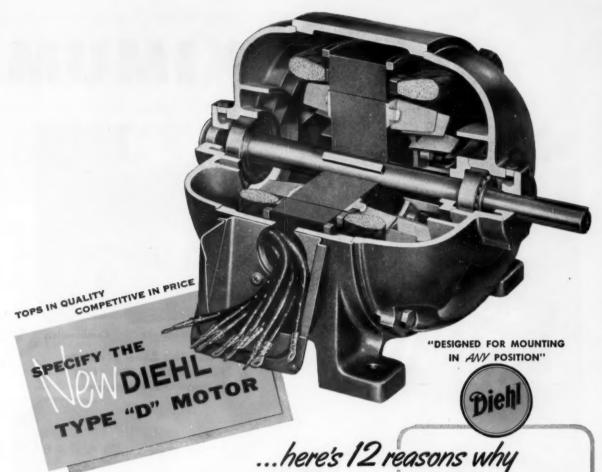


SYLVANIA

Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y.

LIGHTING · RADIO · ELECTRONICS · TELEVISION

In Canada: Sylvania Electric (Canada) Ltd., University Tower Bldg., St. Catherine Street, Montreal, P. Q.





Designed and engineered for more efficient performance. Smaller in size, lighter in weight and quieter in operation.

Consult our engineers before writing your specifications and get the benefit of 68 years of experience in the design and manufacture of general and special purpose motors

Diehl motors will still be available in old NEMA Standard frame sizes for interchange and replacement.

- Most Advanced Slot Insulation
- Machine Fitted Stator
- Rotor Keyed to Shaft
- New High Dielectric Insulated Stator Windings
- Permanently Numbered Leads
- Conduit Box, An Electrician's Delight
- Centrifugally Cast, High Density Rotor Windings
- Rugged Stress-Relieved End-Covers
- New Pre-lubricated Heavy Duty Ball Bearings
- Locked-in Ball Bearing
- Dual Ventilation System
- Extra Strong Cast Iron Frame

Electrical Division of THE SINGER MANUFACTURING COMPANY
Finderne Plant, SOMERVILLE, N. J.

Please send me the following bulletins

- ☐ New Type "D" Motor Bulletin No. EC-3304
- Consolidated Catalog & Price List No. EC-3310

Name____

Company

Site et .

INTEGRAL AND FRACTIONAL HORSEPOWER MOTORS ARE AVAILABLE IN A WIDE RANGE OF TYPES AND SIZES

MAXIMUM

ALLIS-CHALMERS STARTERS



Manual

Magnetic

Combination

Across-the-Line Starters

For squirrel-cage motors from fractional to 600 horsepower.

is the producer of world's largest line of major industrial equipment.

Out of the many Allis-Chalmers plants rolls the most diversified array of processing machinery as a complete line of electrical well as a complete line of electrical generating, distribution and utilization equipment. As a result, A-C generating, distribution problem ization equipment called upon thousands of control problems in practically every industry. Solve thousands of control dustry. I lems in practically every indesign, and application is manufacture and application is manufacture and specify ...

ALLIS-CHALMERS



Manual

Magnetic

Reduced Voltage Starters

For squirrel-cage motors from 5 to 2500 horsepower. Available in autotransformer, reactor and primary resistor types,

ALLIS-

Line-to-Motor PROTECTION

... The Right Starter for the Specific Job

Built into every Allis-Chalmers starter is the type and degree of protection dictated by the application. Let's take a theoretical example . . . a starter controlling a 1000-hp, 2300-volt synchronous motor driving a ball mill.

In this case the starter could offer the following protections:

- 1. Ac undervoltage protection
- 2. Three-phase thermal overload
- 3. Open and reverse phase
- 4. Damper winding

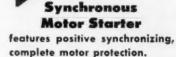
- 5. Instantaneous shutdown on pullout
- 6. Dc undervoltage
- 7. De field failure
- 8. Short circuit protection

Of course, specific protection requirements vary. That's why Allis-Chalmers starters are recommended and applied with expert personal attention to the problem at hand.

In addition to necessary protection, starter functions, varying with the specific job requirements, include full voltage or reduced voltage starting, acceleration, speed control, reversing or non-reversing and dynamic braking. All Allis-Chalmers starters are available in general purpose and special enclosures to meet your requirements.

For complete information call your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4250





For Wound Rotor Motors
Available in manual, mag-

netic and semi-magnetic types.

For 2300-2500 Volt Squirrel-Cage Motors Full voltage starting. Particularly

Full voltage starting. Particularly applicable in dusty, corrosive atmospheres and hazardous locations.



CHALMERS

AC ALLIS-CHALMERS



MIDGET SIZE

Power

NOW AVAILABLE IN 100 AMPERE CAPACITY

with plug-in outlets on 12-inch centers

For small plant equipment — power tools, small machines and motors, return lubricating systems, production benches and machine illumination — Midget Size POWERPLUGIN is the efficient, economical, flexible and convenient system of power distribution.

Redesigned to broaden its use through an increase of 66% percent in its capacity and by closer spacing of outlets, the new Midget POWERPLUGIN Busduct provides "plug in and go" power for virtually every type of small equipment, affords substantial savings by eliminating long lead-ins with a resultant voltage drop, and makes it possible to move machines in and out of production lines without slowing down or delaying operations.

Approved by the Underwriters' Laboratories, Inc., for label service, the new Midget @ POWERPLUGIN is only $3\frac{1}{2}$ inches wide and 2 inches deep in size. It is available in standard 5 and 10 foot lengths and can

be arranged to fit almost any requirement. While standard sections have plug in outlets every twelve inches, additional outlets and special lengths are available on specific order.

Midget POWERPLUGIN is available in 100 amp., 250 volt feeder capacity for 2, 3 or 4 conductor solid neutral types for equipment requiring connections for ½ to 3 HP, 240 volt motors or less AC or DC and 7½ HP maximum for motors with dual element fuses. The 2 and 3 conductor types provide 220 volts single phase or three phase power to motors while the 4 conductor type provides single or three phase power for motors and 120 volts for machine illumination.

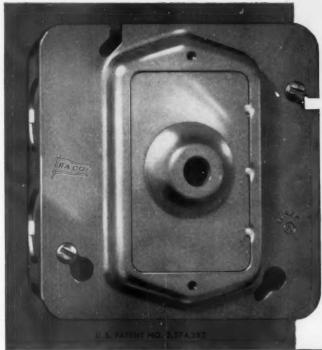
Recommend this new and more efficient, flexible system of power distribution to all your customers interested in greater plant efficiency. For complete information, contact your nearest @ representative listed in Sweet's, or your @ distributor. Or send for Bulletin No. 720.

Frank Adam Electric Co.



P. O. BOX 357 . ST. LOUIS 3, MISSOURI

Makers of: BUSDUCT . PANELBOARDS . SWITCHBOARDS . SERVICE EQUIPMENT . SAFETY SWITCHES . LOAD CENTERS . QUIKHETER



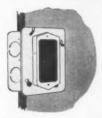
NEW RACO LOCATOR COVER

MAKES IT EASY TO FIND OUTLET BOXES IN NEWLY PLASTERED WALLS

COMPARE THE COSTS PER OPENING!

No. 788-1/2" Raised . No. 789-34" Raised

cost-dollars



Box and device ring installed ready for the plasterers. Opening is unprotected. Location is unmarked.



Plastering completed. Some boxes may be completely covered by plaster.

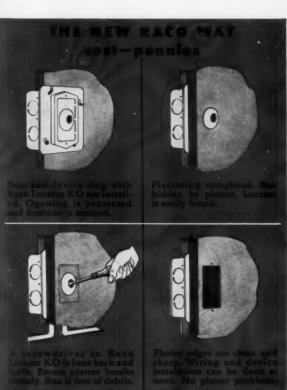


Box located by tapping or painting wall with water. Plaster fragments fill box and conduit. Plaster cracks.



Both box and conduit must be cleaned. This is time con-suming and costly. Plaster requires patching.

WRITE TODAY!



ALL-STEEL EQUIPMENT INC. AURORA, ILLINOIS



Here's a good reason why
It's wise to buy
On over-all cost ...
not price





I-T-E Circuit Breakers keep production lines on the go!

Production time's too precious a commodity—to waste on costly, unnecessary power interruptions!

That's what one production superintendent has recognized. He's been replacing fuses so often, that he's going to replace the fusible device—with a modern I-T-E circuit breaker.

Next time there's an overload or short circuit on the line, there'll be no waiting ... no costly delay. The I-T-E circuit breaker will be reset quickly—service will be restored in a hurry. (And no one has to remind him of one obvious fact: he could have bought a lot of breakers for what this production downtime just cost!)

Remember—in electrical protection, overall cost is the cost that counts. Check with your local I-T-E distributor, and see how much more economical modern I-T-E Circuit Breakers really are—compared with fusible-type protective devices.

I-T-E Circuit Breaker Company, 19th and Hamilton Streets, Philadelphia 30, Pa.

"TEN REASONS WHY" I-T-E CIRCUIT BREAKERS PROVIDE THE UTMOST IN MODERN CIRCUIT PROTECTION

- They offer the highest degree of safety to personnel.
- They reduce production downtime.
- 3. They eliminate replacement costs and maintenance.
- 4. They are completely tamperproof.
- 5. They are pretested to insure uniformity of operation.
- 6. They prevent single phasing when a fault occurs.
- 7. They safely carry their continuous current rating indefinitely.
- 8. They save mounting space.
- They offer a wide range of special attachments and enclosures.
- 10. They incur low watts loss.



I-T-E CIRCUIT BREAKER CO. Philadelphia, Penna.

The other side of this handy pocket card tells you how to select I-T-E Molded Case Circuit Breakers for various feeder and branch circuits. Write for card and other application data, or see your local I-T-E Distributor.

I-T-E Individually Enclosed Circuit Breakers



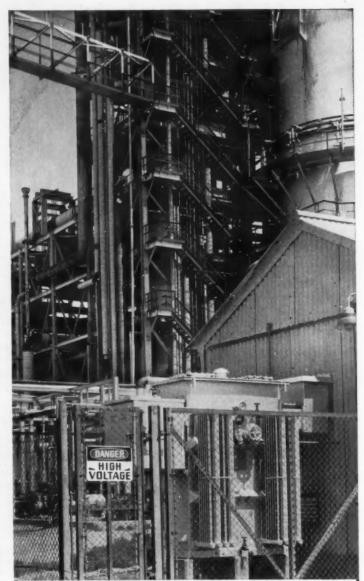
CHOOSE WAGNER UNIT SUBSTATION TRANSFORMERS for always dependable power...

Here's dependability at work! This Wagner liquid-filled unit Substation Transformer feeds the catalytic unit at The Carter Oil Company refinery in Billings, Montana.

You'll find hundreds of Wagner Transformers, furnishing always dependable power, in spots where failure would incur great cost, because Wagner Transformers are known for their unfailing dependability—a reputation backed by more than sixty years of transformer building experience.

Wagner Unit Substation Transformers, both liquid-filled and dry-type, are carefully designed to meet distribution requirements. Both liquid-filled and dry-type unit substation transformers are built in ratings through 2000 kva, 15 kv and below—you can choose the type and rating that exactly meets your load-center distribution requirements.

Bulletins TU-13 and TU-56 give full information. Your nearby Wagner engineer can help you solve your loadcenter problems. Call the nearest of our 32 branch offices, or write us.



This 750 kva, 2400/4160Y to 480 volt, 60 cycle, three-phase, liquidfilled Wagner Unit Substation Transformer feeds the catalytic unit at The Carter Oil Company, Billings, Montana refinery. It is throat connected to switchgear in the adjoining building. Purchased and installed by The Fluor Corporation, Ltd., Engineers and Constructors for the Petroleum, Chemical and Power Industries, Los Angeles.



WAGNER ELECTRIC CORPORATION
6413 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE
BRAKE SYSTEMS—
AIR AND HYDRAULIC



USE THE CABLE THAT FITS THE JOB!

THE JOB...
Airport and Runway Lighting

THE CABLE ..

Hazasheath Type RR Underground Cable

Dependability is a rigid requirement in a job such as runway lighting, and operating conditions are often the worst. Hazasheath Type RR underground cable, approved by the C.A.A., is designed to give this dependability... simple construction and light weight mean fast handling and easier splicing and terminating.

Outstanding resistance to mechanical damage, chemical action and moisture is assured by the extra rugged Hazaprene protective sheath, tough rubber-filled tape and Watertite heat and moisture resisting rubber insulation. This strong, resilient and moisture-resistant construction has proved its durability in underground and aerial installations.

Ask your Hazard representative for further information on Hazasheath Type RR underground cable or write Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pa.



HAZARD

insulated cables



THERE'S NO GAMBLE INVOLVED



Not when you stock, specify and sell Rodale's quality line of more than 600 superior electrical wiring devices and TURN-TYTE interlocking connectors. You'll roll a lucky 7 every time with Rodale's precision-designed, factory-tested, job-proven devices . . . whether it's a product for home or industry.

Delivery, service, dependability and durability plus price are only some of the factors which make Rodale's complete line your best bet. Bet? It's a sure thing.

LOOK TO Rodale FOR PROFIT IN -

Attachment Plugs **Battery Clips** Bead Chain & Accesseries Bushings Cleat Receptacles Convenience Outlets **Cord Connectors** Cord Sets Current Tops Door Bells & Buzzers Extension Sets **Fixture Parts** Flashers Fluorescent Sackets Flush Switches Foreign Devices Fuse Plugs Ground Clamps **Grounding Devices Heating Elements** Industrial Plugs Insulators Iron Plugs Knife Switches Lamps & Shades Lamp Sockets Pilot Lamp Accessories Radio Aerial Parts Range Cords & Receptacles Receptacles Shade Holders Socket Adapters Socket Reducers Spot-Lite Accessories Staples Switches "T" Polarity Devices Terminals Testers Transformers Trouble Lamps Wall Plates W. P. Sockets

and



interlocking devices

Rodale MANUFACTURING CO., Inc.

FACTORY, GENERAL OFFICES: EMMAUS, PA.

CHICAGO WAREHOUSE

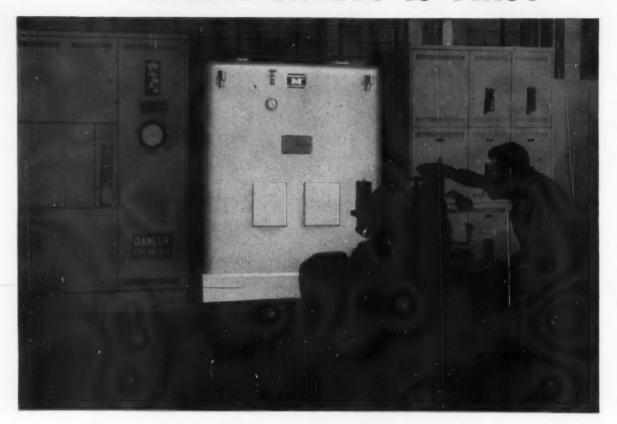


LOS ANGELES WAREHOUSE 338 E. 2nd STREET

Representatives in all Principal Cities

solid foundation FOR TODAY'S COMPACT MOTOR DESIGN There are, as you know, new NEMA Standards for electric motors ... more power in less space. When you look for a new NEMA frame motor, look for the one that is built on a solid foundation...it carries the Fairbanks-Morse Seal of Quality. The Standards are new.. But the Idea Is Not Like the recent Fairbanks-Morse developments in other lines, the new F-M motor is the result of a basic engineering philosophy: More Performance in Less Space-a 120-year tradition at Fairbanks-Morse. Fairbanks, Morse & Co., 600 South Michigan Avenue, Chicago 5, Illinois ELECTRIC MOTORS AND GENERATORS . DIESEL LOCOMOTIVES AND ENGINES . PUMPS . SCALES . RAIL CARS . HOME WATER SERVICE EQUIPMENT . FARM MACHINERY . MAGNETOS MOTOR DESIGN SCALE DESIG

WHERE SAFETY IS FIRST



Specify Moloney Class "H" Dry Type Transformers . . .

Safety of men or machines is no problem when you install Moloney Nitrogen sealed Class "H" insulated Dry Type Transformers. For Moloney offers you more in increased protection against fire and explosion hazards. These versatile and dependable transformers can be located indoors or outdoors right next to the job and more than meet the most exacting insurance requirements. And this also means important savings in costly copper connections..: less danger of accidental power interruptions.

Nitrogen filled Class "H" insulated Dry Type Transformers do not produce toxic gases, never need expensive vault installations. Maintenance is easy and the nitrogen atmosphere protects insulation from oxidizing, means longer, more dependable transformer life.

Solve your load center problems the practical way with the modern transformers that go where you want them—the Nitrogen sealed Class "H" Dry Type Transformers with the "extra value" that is the mark of Moloney.



MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers * Distribution Transformers * Load Ratio Control Transformers * Step Voltage Regulators * Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES . FACTORIES AT ST. LOUIS, MO. AND TORONTO, ONT., CANADA

Wanted: Dealers, Electrical Contractors to sell new **Exide** LIGHTGUARDS

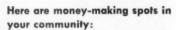
Profits unlimited, tremendous sales potential. There are hundreds of money-making opportunities all around you to sell Exide Lightguard emergency lighting protection! Everywhere people gather there is a possible sale for Exide Lightguards. Send coupon now for full details.

YOU CAN CASH IN AS A DEALER

Power interruptions can happen anywhere, anytime, despite every precaution taken by utility companies. Every public gathering place needs emergency lighting—needs the protection of Exide Lightguard: Factories, Schools, Hospitals, Theaters, Restaurants, Hotels, Stores and Markets, Banks, Police Stations. And as many as 200 Exide Lightguard units are deemed necessary by some industrial plants!

YOU can quickly build extra profits for yourself.

Emergency lighting protection is now required by law in many cities and states—another reason Exide Lightguard units offer good sales opportunities for electrical dealers and contractors. Write for full details—the Exide Lightguard unit has many other easy-to-sell user benefits!



SCHOOLS • HOSPITALS • HOTELS • CHAIN AND DEPARTMENT STORES • INDUSTRIAL PLANTS • RESTAURANTS • APARTMENTS • BANKS • CHURCHES • COMMUNITY CENTERS • INSTITUTIONS • LIBRARIES • OFFICE BUILDINGS • POLICE STATIONS Lighting protection is needed for:

sales floors • open counter displays • cashier's cages
• corridors • aisles • dining rooms • lobbies • boiler
rooms • engine rooms • switchboard rooms • machine
shops • payroll departments • loading platforms
• bank vaults • auditoriums • exits • medicine
rooms • firetowers • stairways • swimming pools •
locker rooms • court rooms



Model M, double lamp unit

THE ONLY COMPLETELY AUTOMATIC EMERGENCY LIGHTING UNIT ON THE MARKET!

It operates instantly and automatically on any interruption to the normal A.C. power supply. Provision is made so that it automatically recharges itself upon restoration of normal power.

MALL THUS COURON NOWA

Exide INDUSTRIAL DIVISION

The Electric Storage Battery Company Philadelphia 2, Pa.

Send me all the facts, I want to cash in on emergency lighting. Rush specifications, wiring systems, sales information on NEW EXIDE LIGHTGUARD UNITS.

NAME		
ADDRESS		
CITY	ZONE	STATE
My business is:	☐ Electrical Cont	ractor; Consult-
ing Engineer;	Architect; Dist	ributor; Dealer;
☐ Electrical En	gineer; Other	

FOR "ROUND-THE-CLOCK" CIRCUIT SECURITY-

Multi-conductor control cables have color-coded Okoprene over each conductor with an Okoprene sheath over-all. Okolite-Okoprene cables can be furnished with interlocked bronze armor where troughs or trays are used.

If desired, Okolite-Okoprene cables can be supplied with a lead sheath. (Note rubber fillers.)

OKOLITE-OKOPRENE CONTROL CABLES

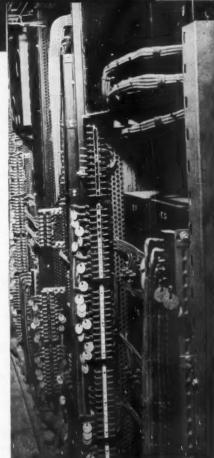
Control cable must be the most versatile of all types of cable. In its wide variety of uses, control cable may be called upon to operate under almost any kind of service condition.

Horizontal or vertical, indoors or out, above or underground, in wet, dry, hot or cold locations, exposed to oils, acids, chemicals, sunlight or any kind of weather—control cables must keep key circuits operating around the clock.

Okolite-Okoprene is one type of cable construction that fulfills every requirement for control cable. The principal reason for its usefulness as control cable is the unique combination of Okolite Insulation and Okoprene Sheath. These two combine the highest dielectric strength with the most impervious protective covering... resulting in an unequalled soundness both electrically and physically.

Yet there are many other features which contribute to Okolite-Okoprene's outstanding performance as control cable. *Bulletin EC-1056* gives full details and specifications, with a description of Okonite's famous strip insulating process, special Okoloy conductor coating, a-c and d-c super-voltage testing, and many more.

If your expanding electrical plans call for additional control circuits, make sure you use the one cable qualified to give you "round-the-clock" security: Okolite-Okoprene. Inquire today from The Okonite Company, Passaic, N. J.





THE BEST CABLE IS YOUR BEST POLICY

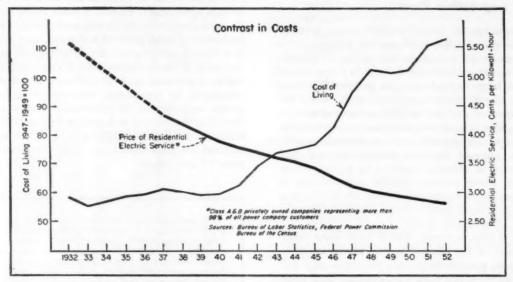
ITE insulated wires and cables

A 20-YEAR RECORD ...

The Electric Power Companies' Case for Public Confidence

An economic study of the record of the investorowned electric power companies of the United States over the past twenty years underwrites their claim to public confidence today. A key factor of this record is set forth by the chart in the middle of this page. This shows that while the cost of living as a whole has almost doubled, the average price of electric energy for residential use in the United States has been cut in half. performance of these companies during World War II, J. A. Krug, Director of the Office of War Utilities, said, "Power has never been too little or too late." The same can be said for the entire period of the past twenty years.

To be ready with enough power - on time the electric power companies have expanded their production fourfold since 1933. This has required an investment of over \$17 billion in new



The average prices of industrial and commercial power also are much lower than they were twenty years ago.

Such a study confirms the record on other key accomplishments of the electric power companies during the past two decades.

They have not failed, either in peace or war, to meet the nation's rapidly expanding electric power requirements. In paying tribute to the

facilities. To raise the funds for this investment they have enlisted the participation of about 3 million direct stockholders. Through life insurance companies, banks and similar institutions, about 90 million Americans — more than half of the nation's total population — have become investors in electric power companies. By thus relying on private investment for their expansion, the power companies have provided their

plant and operating equipment without burden on the taxpayer.

In addition, the investor-owned companies have paid about \$12 billion in taxes to various governments – national, state and local – over the past twenty years. Unlike government-owned and -operated systems, they have received no public subsidies. When taxes and subsidies are taken into account, the rates for electricity charged by the investor-owned companies have been as low as, or lower than, those charged by government-owned and -operated systems.

Many Americans do not appreciate the job that the power companies have done over the past two decades. That is due, in part, to the public memory of financial abuses by some utility holding companies during the 1920's. This memory obscures a clear and unprejudiced view of the progress since those days. And some of the all-out advocates of reliance on government rather than on regulated private enterprise for the development of our power resources do their best to keep this memory of the past alive in the present.

An Impressive Case

Some special cases of electric power development may involve problems for which the investor-owned companies are unable to provide full solutions. This may be true, for example, of some large multiple-purpose projects that combine electric power generation with related developments such as the improvement of navigation, flood control and the irrigation of arid lands. Some of the economic and administrative problems imposed by such projects are not well adapted to effective handling by private enterprise. Flood control and the improvement of navigation, for example, usually involve the provision of much costly service over and above the cost of producing power.

It is true, however, that in some cases development of the electric power side of multiple-purpose projects by private enterprise may well be more feasible than would appear from statements by some government power advocates. And the record indicates that even in those projects on which both the power generation and the other services are handled by public authority, it may well be desirable to have the investor-owned companies assume the transmission and distribution functions.

Our study of the record of the investor-owned and -operated companies over the past twenty years has led us, of course, behind the statistics that bear on the wisdom of giving them a priority in the development of our power resources. It reveals that these enterprises are manned by people who, through lifetime experience, are peculiarly conversant with the needs of the communities they serve. They have given the consumer notably good service while conforming to standards set and enforced by public regulatory commissions. They have won the confidence of the investing public. By their nature and their experience they are competent to handle any power program that can be demonstrated to be economically sound.

The Paramount Public Interest

By their economic performance during the last twenty years, the electric power companies have earned the confidence of the public. By relying on these companies to meet its electric power requirements the public will fully protect its economic interest in ample and efficient service at fair prices.

That is where our study comes out. Our findings do not touch the political consideration that private operation of electric utilities under public regulation is a safeguard against further concentration of both political and economic power in a federal government that already commands too great a concentration. But if these findings make an economic case for preferring power development by tax-paying business as against power development by governmental agencies, they clear the way for an appeal to the paramount public interest in safeguarding our personal and political freedoms against the further encroachment of government.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

Permission is freely extended to newspapers, groups or individuals to quote or reprint all or parts of the text.

Donald CMcGraw PRESIDENT

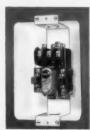
McGRAW-HILL PUBLISHING COMPANY, INC.

1 Noble & Westbrook shell-marking machine with
Bulletin 609 manual flush starter
all flush-type
starter.

3 Hamilton No. I
gear hobber with
Bulletin 709 flush
starter in machine
base or frame.

FLUSH-TYPE MOTOR STARTERS





Bulletin 609 Size 1 Manual Starters for flush cavity mountings





Bulletin 709 Size 1 Solenoid Starters for flush cavity mountings





When you design a new machine

modernize its appearance with flush-type starters

It is a sales asset to any device to have a trim, streamlined appearance... and it costs so little if you think of it while your product is still on the drawing board. A good place to start is to include convenient recesses or cavities in your machine frames or pedestals for flush-type Allen-Bradley motor controls.



Allen-Bradley manual and magnetic starters are available in snappy looking faceplates and skeleton mountings, ready to slip into your machine frames. See illustrations above.



Your nearest Allen-Bradley control engineer will gladly call at your convenience and discuss the flush-type starters best suited to your need. (See illustrations at left.) Allen-Bradley controls are your assurance of trouble free operation and long life.

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.

4-54-M



CONTACTORS

A-C & D-C · Sizes 00 to 7 · Ratings 10 to 900 Amperes





2 pole—Size 1 25 ampere

3 pole—Size 1 25 ampere



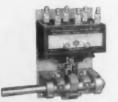
4 pole—Size 1 25 ampere



5 pole—Size 1 25 ampere



10 pole—Size 1 25 ampere



3 pole—Size 2 50 ampere cam-operated

ALL SOLENOID OPERATED





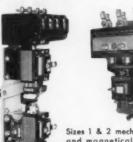
Contacts Open

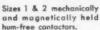
Contacts Closed

Here is the only complete line of solenoid contactors on the market...We have nine sizes from the little Size 00 (10 amperes) to the big Size 7 (900 amperes).

What does this mean to you? It means that all of your contactor requirements... from the smallest to the largest... can be met with Allen-Bradley trouble free solenoid controls. There is no contact maintenance... no pins, pivots, or bearings to stick and give trouble. Just one moving part—the simple solenoid plunger. Operating characteristics are consistent throughout all nine sizes.

Enclosures are available, too, for general purpose, watertight, dust-tight, and explosion-proof service. Allen-Bradley controls are a sales asset to any electrical device. May we send you our latest catalog?









2 pole—Size 2 50 ampere

3 pole—Size 2 50 ampere



3 pole — Sizes 4 & 5 150 & 300 ampere contactors



3 pole — Sixes 6 & 7 600 & 900 ampere contactors

Allen-Bradley Co. 1316 S. Second St. Milwaukee 4, Wisconsin



ALLEN - BRADLEY
SOLENOID CONTACTORS

4-54-M



What the stethoscope is to the Doctor, There is an Amprobe for the Amprobe snap-around volt-ammeter is to the electrician, contractor, plant maintenance man, refrigeration, motor and appliance serviceman.

With an Amprobe, you can measure current instantly without having to shut down equipment. You can measure voltage with instrument accuracy, on a full-size calibrated scale. All this with one rugged and inexpensive pocket-size tool!

Eliminate guesswork, save time and money on practically every call, reduce expensive call-backs, gain respect as a well-equipped professional—
"Amprobe" it! You'll wonder how you ever got along without one.

every job, every budget

AMPROBE Jr.

Now every man can afford to carry an Amprobe. 7 models from 0-10 to 0-100 amps; choice of 0-125/250 or 0-150/600 volt A-C range. \$19.85

AMPROBE 300

The ideal Amprobe model for all-around work. Covers 6 ammeter ranges up to 300 amps, and 3 volt-meter ranges up to 600 volts A-C. \$49.50

AMPROBES 600 & 1200

Similar to 300, but designed to handle extra-heavy loads-up to 600 and 1200 amps A-C respectively. Model 600 is \$59.50. Model 1200 is \$67.50. Write for valuable service bulletins showing how to save time and money with an Amprobe. Mail coupon to: PYRAMID INSTRUMENT CORPORATION. LYNBROOK, NEW YORK.

(Export Div .: 458 Broadway, New York 14).

Send for these free Amprobe service bulletins:

Pyramid Instrument Corp. Dept. ECM 44, Lynbrook, N. Y.

Please send me the Amprobe service bulletins checked below:

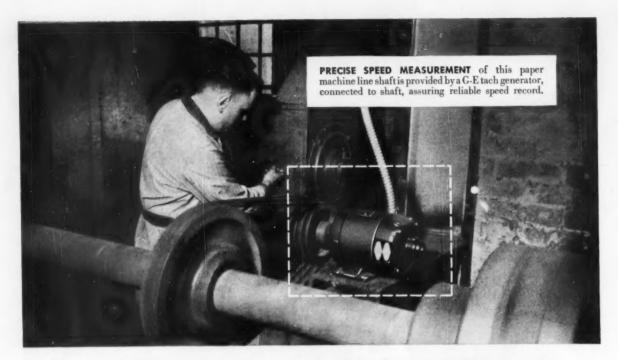
- ☐ How to cut costs and land more jobs
- ☐ Trouble-shooting electric motors
- ☐ How to boost service profits
- ☐ Electrical servicing of hermetic units

COMPANY_

NAME

ADDRESS_ ZONE_STATE

AMPROBE snap-around volt-ammeters



Get closer process control by measuring speed with G-E tachometer generator



G-E TACHOMETER GENERATOR connected to an indicating or recording instrument provides one of many accurate control systems obtainable with G-E d-e products.

A precise speed measuring method—using G-E tachometer generators—is one of the many advantages you get from General Electric d-c motors. The tach generator (shown at left) can be located as far as several thousand feet from a recording or indicating instrument. They indicate rotational speeds from 1 to 15,000 rpm . . . permit immediate manual speed adjustment.

BECAUSE ONLY D-C MOTORS can be controlled over a wide range of characteristics like speed, torque, voltage, etc., more and more G-E d-c products are being used to assure maximum utilization of expensive modern machinery. You can get efficient, more automatic, modern production with G-E d-c products such as the tachometer generator above, d-c motors, motor generator sets, amplidynes, and thy-mo-trol* motors.

USE D-C MOTORS for maximum efficiency, and remember that General Electric's Application and Sales Engineers can help you select the right d-c motor for the job to be done.

For more information see your local G-E Apparatus Sales Office or Authorized G-E Distributor. General Electric Company, Schenectady 5, N. Y. 704-11

*Reg. Trode-mark of General Electric Co.

You can put your confidence in_

GENERAL



ELECTRIC



now!

A BRAND NEW WIRING DEVICE

for a big and Profitable Market

The New P&S®

No. 500

U-AD-M
DUPLEX OUTLET

The easiest, quickest, most economical way to add duplex convenience outlets to existing installations.

Entirely New . . . Unbelievably Simple

The new P&S 500 is a self-contained unit . . . No box, no extra clamps, no soldering, no taping necessary. It provides a high quality, double-grip duplex outlet that holds cap blades securely, a wall plate of most modern design and means for fastening in the wall. Everything is in a single package. Ten packages packed in an attractive display carton. Available in Brown (P&S 500) and Ivory (P&S 500-I)

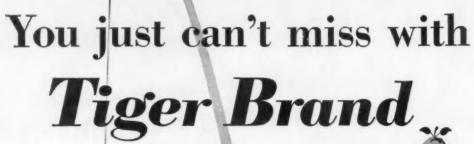
Approved by Underwriters' Laboratories. Guide Card No. 365 E1, File E9664 B

For Complete Information on P&S 500

U-AD-M Duplex Outlets
Ask your Electrical Wholesaler or Write Dept. M

PASS & SEYMOUR, INC.
SYRACUSE 9, NEW YORK

OFFICES: 71 Murray St., New York 7, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill,



Electrical Wire and Cable

Varnished Cambrid



Amercial To withstand physical abuse, moisture, sun and oil, use Tiger Brand Amercial for all sorts of portable equipment.



Amerbestos Tiger Brand Amerbestos is a true quality heat resistant material.

The asbestos is felted for greater durability.





Submarine For underwater power distribution, there's a Tiger Brand Submarine Cable to withstand any operating condition.





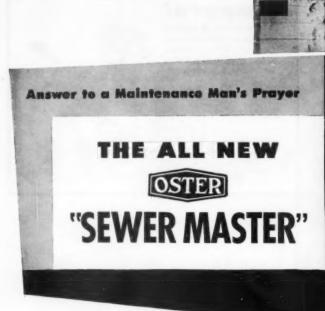
American Steel & Wire specializes in wire and cable that must withstand abusive service. No matter what kind of operating condition you may have, there is probably a standard Tiger Brand Wire or Cable that will give you better service than you ever dreamed of.

Send the coupon and outline your problem. We'll see that you get service-fast.

ELECTRICAL

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS . TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS UNITED STATES STEEL EXPORT COMPANY, NEW YORK





AT last, here's a sewer cleaner that's easy to operate, easy to move... that's powerful and economical.

It only takes one man to operate the new Oster "Sewer Master", and he can use the method he likes best. He can feed the "snake" through the machine using the control handle, or he can feed it by hand. With either method the powerful, easily adjustable chuck jaws grip the "snake" securely and drive the cutting tool into the obstruction.

The "Sewer Master" weighs less than 100 lbs. and has large rubber tired wheels. It's compact and rugged. One man can move it to the job with no strain at all.

The "Sewer Master" motor is powerful, universal, variable speed... and reversible. A flick of a snap switch starts it to work clearing out chips, grease, and other obstructions 100 feet or more from the sewer entrance.

And, best of all, the cost of the "Sewer Master" is low. But don't let the low price fool you. Feature for feature there isn't a machine on the market that can match it.



OSTER

For the complete story on the all new "Sewer Master" see your local Oster Distributor. He offers reliable service and delivery and will give you sound recommendations on the "snakes" and cutting tools that will make your "Sewer Master" do the best possible job for you.

If you don't have your Oster Distributor's name and address, write us. We'll send it to you along with a free, fully illustrated, factual booklet about the "Sewer Master".



THE



MANUFACTURING CO.

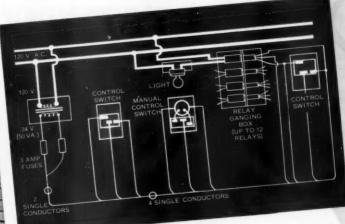
Main Office and Factory

2081 East 61st St., Cleveland 3, Ohio

1893 - CELEBRATING 60 Years Leadership in the Threading Industry • 1953

The Swing is to LOW VOLTAGE CONTROL

ond you'll prefer SQUARE D



Here is a low voltage remote control system with all the features you've wanted...

Because it saves so much installation time, the cost of this very flexible system compares favorably with conventional systems. Actually less, in many cases. It offers a super-convenient means of switching lighting and appliance circuits. It has scores of applications—in homes, office buildings, schools, churches, warehouses, factories.



Relays are extremely rugged. 20 amperes, 120 volts A.C. Also 20 amperes, 277 volts A.C. for low voltage control of high voltage fluorescent lighting. All relays mount in 1/4" knockouts.





Control Switches are toggle type and fit Despard plates and straps. One, two, or three control switches (left, above) or one Manual Selector Switch and one control switch (right, above) can be mounted on a single strap. Manual selector switch controls from 1 to 9 circuits. Key-operated switch also available.



D.C. Power Unit, designed for consistent and trouble-free service. Eliminates A.C. hum.

Relay Ganging Box for speedy, convenient and quiet installations.





Write
for Low Voltage
Control Bulletin.

Address Square D Company, 6060 Rivard Street, Detroit 11, Michigan.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS



SQUARE D COMPANY

Rome FlexAll, single conductor, is manufactured in sizes 14 AWG through 4 AWG. Standard color is black, put up in 500' cartons. Underwriters approved as Type UF-600 volts.

ROME CABLE CORP. 6AWG TYPE UF

ways you can use new



Buried direct in earth, Rome FlexAll is ideal for wiring between buildings.



Installed in livestock buildings or other locations destructive to conventional cables, Rome Flex-All is safe, non-rotting and flame resistant. 

Rome FlexAll is ideally suited for the underground wiring of floodlight installations.

Two and three conductor Rome FlexAll is manufactured in sizes 14 AWG through 10 AWG. Standard color is pearl gray, put up in 250' cartons. Two conductor construction is available with or without ground wire. Underwriters approved as Type UF and Type NMC—600 volts.

ROME CABLE CORP. 12/3



Another Rome product that reduces inventory, saves money!

You will find Rome FlexAll a high quality product, economically priced, and fully approved for multi-purpose use under the 1953 National Electrical Code. It reduces inventory, it is easy to handle, it is safe.

Rome FlexAll to cut installation costs

 D_{ESIGNED} for multi-purpose use, Rome FlexAll is economical, safe, neat appearing and has excellent resistance to the hazards of wet or corrosive locations. They are no longer wiring problems.

A new product of Rome engineering, Rome FlexAll is available with single, two and three conductors for branch circuit and feeder services. It is the answer to low cost industrial and commercial wiring, as well as the wiring of amusement areas, outlying farm buildings and residences.

Specifically, Rome FlexAll, single conductor, is approved by Underwriters' Laboratories, Inc., as Type UF (Underground Feeder), while the two and three conductor constructions are approved as, both, Type UF and Type NMC (Non-metallic Sheathed Cable—Corrosive Resistant). Such dual approval makes Rome FlexAll the inventory-saving choice for branch and feeder circuit work.

Rome FlexAll is recognized by the National Electrical Code for 1953 for the following types of installation:

Single Conductor

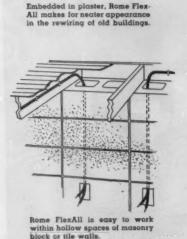
For branch or feeder circuits buried directly in earth when provided with over-current protection.

Multiple Conductor

- For branch or feeder circuits buried directly in earth, as above.
- For interior wiring, either exposed or concealed in dry, wet or corrosive locations.
- For installation within hollow spaces of outside or inside masonry block or tile walls.
- For embedding in plaster or shallow chase in masonry, when suitably protected.

Rome FlexAll, single conductor, has an integrally applied all-resistant Rome Synthinol, Type TW, thermoplastic insulation and sheath. Rome FlexAll, two and three conductor, is insulated with the same high quality compound, with individual conductors covered with an inorganic glass yarn wrap. Over the assembled conductors is an abrasion, moisture, rot- and flame-resistant Rome Synthinol thermoplastic sheath.

If your wiring requirements involve direct burial in earth or the hazards of wet and corrosive conditions...ask for Rome FlexAll.



Chase cut into wall

steel plate for mechanical protection

Corrosion resistant

Solid cement

block or tile

Plaster



It Costs Less to Buy the Best

Use this unconditional lighting fixture warranty to promote business

This seal helps you promote new lighting business... and automatically opens the door to other electrical improvements. It has merchandising power: it advertises, demonstrates, proves and helps sell your own high standards of quality.

Good lighting helps build reputation. It's an electrical improvement the public sees and talks about. It takes just one outstanding lighting improvement in a business block, and others soon follow.

That's why you don't take chances. You guarantee your work—and we have no hesitation in backing you all the way. That's why the Westinghouse lighting fixture warranty is for the exclusive use of electrical contractors who guarantee their work. You name the terms—we'll back you up.

J-04351

Westinghouse



Get This Merchandising Package, Today!

Get your personal copy of the Westinghouse warranty package. Warranty covers the entire line of commercial, industrial and floodlighting fixtures (lamps, starters and labor not included).

Westinghouse Electric Corporation Lighting Division Cleveland, Ohio

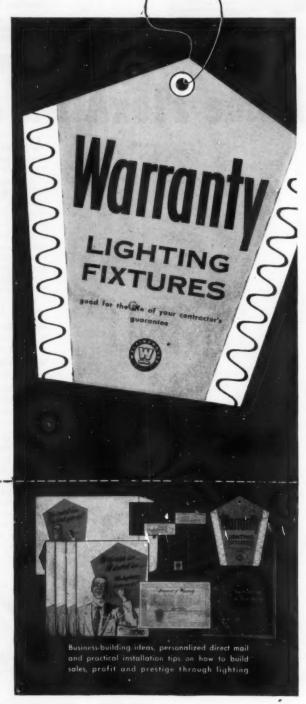
Please send my personal copy of warranty package.

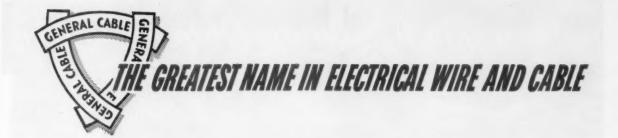
Name

Company

Street____

City_____State____





UNDERWRITERS' FLEXIBLE CORDS and FIXTURE WIRE



Used with confidence with millions of units...



BARE, WEATHERPROOF, INSULATED WIRES and CABLES FOR EVERY ELECTRICAL PURPOSE

As a mass producer of these popular cords and wires for electrical appliances and equipment of all types, General Cable is constantly finding new materials, adapting existing ones, helping to start new trends. Our recent developments will result in savings to you.

General Cable's line of Underwriters' Flexible Cords and Fixture Wires is available with rubber or plastic insulations...with neoprene coverings... with solid and stranded copper conductors. They are designed to resist heat and moisture. They are designed for maximum flexibility. Check General Cable for 600 V and 1000 V fluorescent lighting slim line code approved fixture wire. You name it! We make it! So, don't overlook the convenience and simplicity of buying all your wire and cable needs in one place! It pays!

GENERAL CABLE CORPORATION

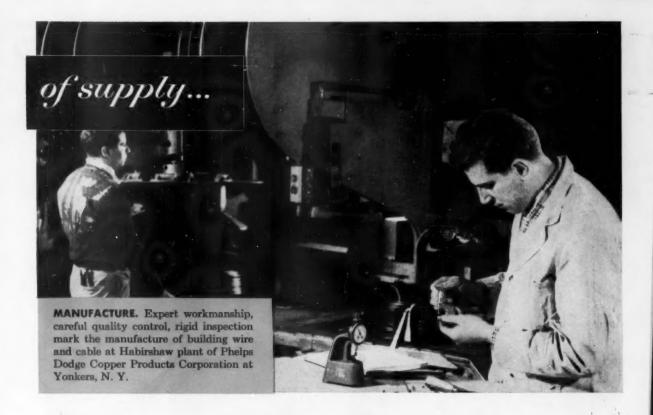
420 Lexington Avenue, New York 17, New York • Sales Offices: Atlanta • Buffalo Cambridge (Mass.) • Chicago • Cleveland • Dallas • Detroit • Greensboro (N. C.) • Houston Indianapolis • Kansas City • Los Angeles • Milwaukee • Minneapolis • New York • Newark (N. J.) • Philadelphia • Pittaburgh • Portland (Ore.) • Rome (N. Y.) • Rossmorn (Ohio) (Cincinnati area) • St. Louis • San Francisco • Seattle • Syracuse • Tulsa • Washington, D. C.

When you need a dependable source



IT PAYS TO SEE A PHELPS





DODGE DISTRIBUTOR!

Phelps Dodge's complete "Mine to Market" program assures distributors dependable supplies and service

Here's what "Mine to Market" means to you:

- 1. A CONSTANT SUPPLY OF RAW MATERIALS.
- 2. HIGHEST QUALITY WORKMANSHIP.
- 3. PROMPT DELIVERY all from one major source.

Phelps Dodge distributors are an integrated part of this system, profit from working closely with a primary copper producer and fabricator.

PHELPS DODGE COPPER PRODUCTS

CORPORATION

WIRE BY PHELPS DODGE MEANS WIRED FOR LIFE!

HERE IT IS! the first <u>NEW</u> socket design in years Sevolier PHENOLIC SOCKET





Extra heavy case of impact resisting molded phenolic

Lamp base screw shell .006" heavier than standard

New push button

Levolier switch

mechanism







Easy to wire
Two piece housing
screws together

new styling - I new safety - new dependability



Combining modern functional styling with utmost dependability, this new McGill 4300 Series Phenolic Socket readily fits all modern plant and electrical equipment requirements. It has a double thick cap and casing of impact resisting molded phenolic enclosing the proven LEVOLIER switch mechanism with a new push button action or the well known universal lever.

Levolier molded phenolic sockets use a two piece housing that screws together at the lever for quick opening and easy accessibility to side terminals.

Its screw shell is .006" heavier than standard, has special high conductivity bronze contacts, and is rigidly supported in the housing. Models include 1/8", 3/8", 1/4" and pendant caps.

The new 4300 series has dependability and lasting quality not available in any ordinary socket marketed today. This 600 watt 250 volt socket defies replacement in rugged industrial service and saves its cost many times over by elimi-

nating maintenance labor and production time losses.

It conforms to all modern safety regulations and is Underwriters'
Laboratories Inspected.



The new push button mechanism is available also in the LEVOLIER 4100 series sockets with double walled brass cap and casing.

Send for Bulletin S-54. This descriptive Bulletin describes the complete line of McGill Heavy Duty Sockets. Send for your copy today.



McGILL MANUFACTURING COMPANY, INC. 450 N. Campbell St., Valparaiso, Indiana



ding

easy"fishing"

The smooth, clean inside enamel finish of Columbia E. M. T. makes wire-pulling easy. The galvanized coating prevents corrosion. Every length is thoroughly inspected before shipment-always uniform. Plus, Columbia gives you service that keeps your installations "on-schedule."



Columbia CABLE & ELECTRIC CORP.

255 Chestnut St. Brooklyn 8, N. Y.



NON-METALLIC SHEATHED CABLE





A.B.C. ARMORED CABLE





FLEXIBLE STEEL CONDUIT

Sales Representatives in Following Cities:

Atlanta, Ga. Boston, Mass. Charlotte, N. C. Chicago, III. Cleveland, Ohio

Coral Gables, Fla. Cincinnati, Ohio Dallas, Tex. Denver, Colo. Detroit, Mich.

Glassport, Pa. Highland Park, Mich. Houston, Tex. Kansas City, Mo. Los Angeles, Calif.

Minneapolis, Minn. New Orleans, La. New York, N. Y. Philadelphia, Pa. Portland, Ore.

St. Louis, Mo. San Francisco, Calif. Seattle, Wash. Thornwood, N. Y. Tulsa, Okla.



Where vibration, motion or shock loosen connections . . .



for UNINTERRUPTED POWER FLOW



LEV-0-LOCK devices are available in 2-3-4 wire caps, connectors and receptacles in 10 and 20 Amp ratings. Approved by Underwriters' Laboratories.

Just a turn of the cap makes a secure connection that will not shake loose . . . that will provide safe, dependable electrical connections under severe usage. LEV-O-LOCK devices incorporate every up-to-date advantage in engineering design, made available by Leviton's half-century experience as leader in the wiring device field. Contacts are double wiping type in all receptacles, and are made of heavy gauge phosphor bronze; extra large terminal screws and ample wiring room provided; quality controlled mass production assures accurate alignment of blades. Send for bulletin LL

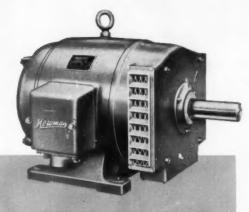


MANUFACTURING COMPANY

BROOKLYN 22, N.Y. CHICAGO LOS ANGELES LEVITON (CANADA) LIMITED, MONTREAL

Great Motors from Great Britain!

the facts behind a high-quality, world-famous line of motors now available in America (N.E.M.A. standards) at savings up to 40%



DESIGN FEATURES

Open Drip-Proof Type provides adequate protection from falling liquids. Windings are insulated with high-quality materials and finally dipped in thermo-setting varnish and baked to give mechanical strength and high resistance to the entry of moisture and oil. Bearings of standard sizes are fitted and are, f ample size to give long life under all drive conditions. Shaft is designed to withstand overloads and shock loads.

Totally Enclosed Fan Cooled Type keeps out dust, moisture, oil and abrasive grit.

with these additional features

- immediate delivery from stock
 any motor sent free for examination and testing
- unconditionally guaranteed
- superior design
- all types and sizes up to 230 H.P.
- offices in principal cities

The first fact is that motors are our business, our only business. Since 1935 we've sold more than two million motors in 62 countries. And we're making and selling a larger volume than ever right now. NEWMAN MOTORS have a world-wide reputation.

Another fact is that economics favor us because we can produce higher-quality motors at relatively lower costs than American manufacturers. And because we are now enjoying a further cost margin from our high production we are offering the lowest prices to the American buyers.

These are high-quality, unconditionally-guaranteed motors in a complete range of totally enclosed fan cooled and open drip-proof designs (squirrel cage and wound rotor) in all sizes up to 230 h.p. Write today, via coupon below, for catalog and price lists.

110wwass

NEWMAN INDUSTRIES (AMERICA) INC.

43 BROAD STREET

NEW YORK 4, NEW YORK

Newman Industries (America) Inc.

43 Broad Street, New York 4, New York

Please send me a catalog and price list of the full line of NEWMAN MOTORS now available in the United States at savings up to $40\,\%$

Attention of

Company Name

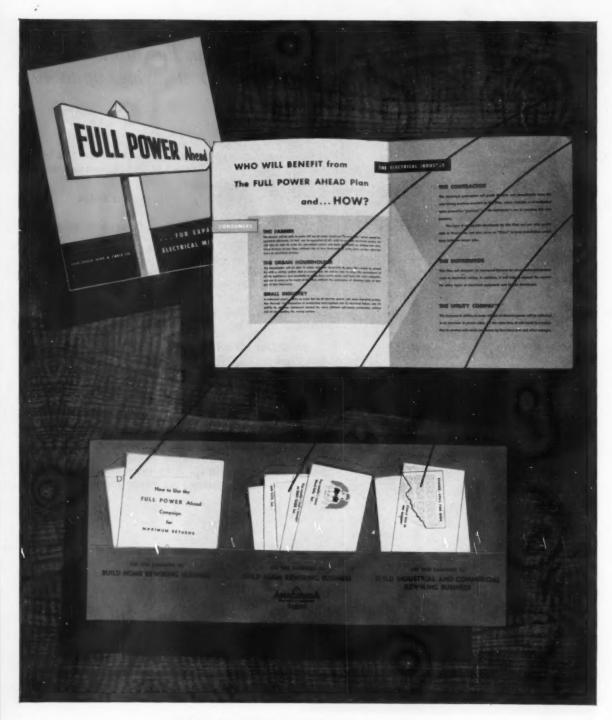
Address

City

State

NOW: another* new Anaconda program to help you...

GET MORE



BUSINESS -- HOMES -- FARMS -- SMALL INDUSTRIALS

"REWIRE NOW!" is theme of new FULL POWER AHEAD Campaign. FREE promotion tools are ready to help you get your share of today's MULTI-BILLION-DOLLAR wiring modernization market.

COMMERCIAL ENTERPRISES

Here's your market. Millions of buildings are more than 10 years old. Their wiring systems were barely adequate when installed and have not been improved since. Now add a steady growth in the uses of electricity. You can see that this market is ripe for aggressive electrical contractors.

3 business-building jobs the FULL-POWER AHEAD Campaign does for electrical contractors

(1) It helps you show consumers — your customers — why they should modernize their wiring for unrestricted use of electrical equipment.

(2) It helps you show them how they can easily afford electrical modernization.

(3) It helps *you* persuade them to take the first step towards electrical modernization — consulting you, the electrical contractor.

Here's how Anaconda helps you develop this profitable new business

Anaconda has prepared a special,

hard-hitting "Tool Kit." This contains everything you need to build business through the FULL POWER AHEAD Program.

You get -at no cost -a series of powerful promotion campaigns. Each sells one market homes, farms, small factories and commercial buildings. The kit contains information about Property Improvement Loans, under FHA Title I, which help break down the "can't afford it" line of resistance . . . help clinch the sale. It gives helpful suggestions on how to compile mailing lists and follow-through on inquiries. Full instructions on ordering, imprinting and mailing campaign literature are also included.

Here's how you can obtain this sales promotion package

You'll want your kit as soon as possible. With it, you can turn up new business... more business. See your Anaconda Distributor for your free "Tool Kit"...and for information about the new FULL

POWER AHEAD Campaign. A lot of rewiring contracts will result from this campaign. Make sure you get your share. Act today. Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

GET MORE BUSINESS FROM LARGE INDUSTRIALS, TOO!

Anaconda has reactivated the successful POWER-UP Campaign. It tells industrial plant executives that there never was a better time than NOW to modernize plant wiring systems — and that YOU can help them do it. Ask your Anaconda Distributor for your free "Contractor Sales Kit"...and cash in on the new business this campaign develops.

ANACONDA

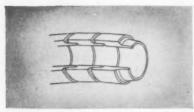
Primary and secondary distribution cable

• building, machine tool, control and communication wire • portable cords and
cables • bus-drop cables • apparatus
cables • copper, aluminum, copperweld
conductors • wire and cable accessories.

^{*}Once again Anaconda takes the lead in industry-wide promotion campaigns. 1936 — Industrial Modernization. 1941 — Preventive Maintenance. 1946 — Wire Ahead. 1950 — Power-Up — And Be Prepared. 1953 — Full Power Ahead.



...with standard fittings for TRANSITE asbestos-



5° bend segment sketched in detail. It consists of a straight section of Transite stock with a male taper on one end and a female taper on the other... each machined at an angle of 2½° to the center axis. Segments can thus be used single, or combined to form bend sections whose curvature is any multiple of 5°.



Photograph showing use of bend segments and curved segments with Transite Ducts.

When you use Transite Ducts, you have available a wide variety of standard fittings, made of the same asbestos-cement material as the ducts themselves. These fittings save time and expense because they provide maximum flexibility in laying out or constructing a duct system. They facilitate clearing unexpected obstructions or accommodating revisions in the original layout.

For instance, the new Transite 5° Bend Segments (shown at left) can be used alone to form simple and complex curvatures of any multiple of 5°. Used with other standard Transite curved fittings, they form curvatures of odd degrees. Thus, they enable you to simplify cross-overs

and transformations . . . to clear obstructions . . . to form unusual or special bend or offset sections. They eliminate the need for purchasing special radii bends or sweeps. The other standard Transite fittings that facilitate directional changes are the offset bends, standard 45° and 90° bends, sweeps, curved segments, laterals, tees, elbows and deflection couplings.

For complete information write for new brochure EL-45-A, "Fittings and Dimensions of Transite Ducts." Contains all dimensional data required by the designer. Also available, "Transite Duct Underground Installation Sheet," EL-43-A. Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto, Ontario.

5 OTHER REASONS WHY TRANSITE DUC'S DO A BETTER JOB AT LESS COST:

1. Corrosion-Resistant. Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.

2. Permunently Smooth Bore. Transite makes long cable pulls easy, under any conditions. Danger of damage to cables is also minimized.

3. Incombustible. Transite will not burn or contribute to formation of

smoke, gases, fumes. It confines burnouts, will not soften under heat.

4. Higher Thermal Conductivity, Cables run cooler in Transite, reducing I*R losses, increasing current capacity and prolonging insulation life.
5. Easy to Install. Transite Ducts are light weight, easy to handle. Joints are quickly made. Long 10-foot lengths reduce number of joints in line.



Johns-Manville TRANSITE DUCTS

TRANSITE KORDUCT-for

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

DRIVE

a better bargain in bid competition

with the safer, action packed

(ITY-PO DRIVER

Because getting the job done faster, for less, is a big factor in meeting today's increasing competition, the speed and safety advantages of the Velocity-Power Driver are vital

This modern production-maintenance tool lets you finish off those fastening and anchoring jobs simply, easily, instantly. Just load-position-fire! Job's done. Inter-

changeable barrels let you drive either ¼ or %-inch studs

from the same firing unit. You have a wide selection of

studs-solid head, internal or external threaded types. And

because the cartridge and stud are integral, there's no time

wasted matching and fitting-they're ready for use.

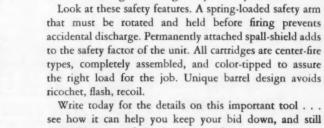
There's no slow-down on those narrow, recessed spaces or close-to-the-wall jobs. The spall-shield is readily retractable, or a portion of the shield can be rotated out of the way. Quadrant marks on the shield provide accurate installation of the stud.



ALSO AVAILABLE

The Velocity-Power Driver, with separate spall-shield, features all the advantages of the above unit. This serviceable Driver is especially useful when a great deal of work in deeply recessed areas is required.





in your contracting picture.

see how it can help you keep your bid down, and still maintain your profit level on every job.

VELOCITY POWER TOOL COMPANY

201 North Braddock Avenue, Pittsburgh 8, Pa.

Tests, comparisons and experiences have proved that all air-cooled dry-type transformers are not alike

THAT there is a difference in dry-type transformers was revealed in the findings of a survey made by *Plant Engineering*, a trade publication, which mailed 500 questionnaires to users of dry-type transformers. (A copy of this report will be sent on request.)

Most of the users who returned questionnaires reported having very favorable experiences with aircooled dry-type transformers. A number of unfavorable reports listed the following reasons. "Some makes won't even handle their rating." "Some are very noisy." "Primary shorts." "The insulation breaks down without overload in relatively short time." Some recommended "mounted lugs for connections."

The unfavorable comments above do not apply to Sorgel air-cooled dry-type transformers.

SORGEL air-cooled dry-type transformers are guaranteed to carry the full rated load continuously, and are so liberally designed that they can safely carry an overload during an emergency. They are well known for their quiet operation. All are equipped with solderless terminal lugs.

Because these superior features cost more to incorporate in Sorgel air-cooled transformers, our price may not always be the lowest; however, the little additional price you might sometimes pay will be saved several times over in extra service and lower installation costs.

All self-contained in a single unit. No separate mounting brackets or junction boxes to lose or to

handle. Three-phase transformers are also in a single unit, with simple connections to make.

Substantial wall brackets with slots for bolts or floor mounting base are an integral part of Sorgel transformers. Roomy connection compartment with wide choice of knock-outs. All transformers are equipped with solderless terminal lugs, and permanent connection diagram. Can be installed in any convenient place inside of buildings, close to load center, resulting in better voltage regulation, more efficient distribution, and lower wiring cost.

SORGEL air-cooled dry-type transformers are top quality, time-tested, and are therefore recognized and accepted by discriminating engineers and users. These transformers are available in a large variety of sizes and types for every purpose. ½ Kva to 1,000 Kva single phase. 1 Kva to 3,000 Kva 3-phase. All standard voltages, such as 120, 208, 240, 480, 600, 2400, 4160, 4800, 7200, 13,200, and up to 15,000 volts, and any intermediate or special lower voltages.

SORGEL dry-type transformers are also incorporated in substations, complete with primary and secondary switchgear.

The Sorgel Electric Co. has nearly 40 years of continuous experience in the development, manufacturing and application of dry-type transformers.

Stock carried by jobbers in the following cities:

Chicogo, Illinois Cleveland, Ohio Los Angeles, Calif. Milwaukee, Wis. Rock Island, III. Rockford, III. Richmond, Ind. Beaumont, Tex. Davenport, Iowa Cedor Rapids, Iowa Omana, Nebraska

Special Transformers and Saturable Reactors



Consult the classified section of your telephone directory or communicate with

Sorgel Electric Co.

836 West National Ave. Milwaukee 4, Wis.

Washington Report

Optimistic predictions for an upturn in business are becoming scarcer, even from staunch Administration supporters. Treasury Secretary Humphrey has predicted no improvement before May. President Eisenhower stated some weeks ago he would look at March data on employment and production before taking anti-recession action—presumably freer credit, tax reductions, eventually public works programs.

Politicians, briefed by professional and Government economists, make most of the predictions and remain optimistic, with fall elections in mind.

Economists are less optimistic, maintain that "adjustments" may continue for some months, possibly until fall. Predictions short term are varied with considerable disagreement—long term, are unanimous for recovery and growth. There's little or no talk of depression, or a big slide, however, and even the pessimists admit that declines over the past several months are small, possibly "about 5% in the nation's total output of goods and services—from \$367-billion in 1953 to \$350-billion in 1954".

Sales of durable goods in 1954 will drop about 8% below 1953, producers expect, according to a recent Commerce Department survey. Steel production has ranged downward to February 1950 levels, but consumption is reported ahead of current output and an early rise is predicted. Auto production, held down during first quarter, is moving ahead at a better pace. An FRB survey shows buying plans of consumers are still fairly high, with enough money to support a high level of business activity.

New building construction continues to set new records, contrary to most other economic indicators. Depts. of Commerce and Labor reported February spending for new construction at \$2.3 billion, 1% more than in same 1953 month. Total for first two months was \$4.7 billion, 2% gain over a year earlier.

Building materials manufacturers reported in mid-March that sales and orders were at least level with 1953's record highs, and in some cases higher. Dept. of Commerce reported construction costs down slightly in last quarter of 1953, but up 2.3% for the year as compared with 1952.

Housing starts in February were 73,000, BLS reported, up over 10% from January's 66,000, for a seasonally-adjusted annual rate of 1,180,000. NAHB has proposed liberalization of the Administration's housing bill to encourage building of 2-million new or "new-conditioned" older homes annually for the next two years. The Air Force has urged extension of the Wherry Act to aid construction of housing at military installations, and AFL and CIO have urged at least 2-million housing units annually until 1960, including at least 200,000 low rent public housing units annually for the next three years.

The 136,500 private home starts during January and February was about 4% below 1953 starts, and the 2,500 public housing starts about one-fourth the 1953 two-month total.

Perpetual controls on scarce metals have been proposed by Defense Mobilization Board, headed by Arthur Fleming, ODM chief. Idea is to keep allocation-and-priority machinery idling indefinitely as a security measure—in case of future emergency, controls could be put in effect overnight.



Better quality, Bigger profits —a better buy



No. 50 3-speed Motordor

Rou can rely on MOTORDO

MOTORDOR KITCHEN FANS and
ELECTRIC FAN-TYPE HEATERS

for more and EASIER SALES - BIGGER PROFITS

HOME-OWNERS' PREFERENCE FOR

BROAN WIDELY ESTABLISHED...

BROAN CO-OP LOCAL PROMOTION

INCLUDES FIVE YEAR GUARANTEE

For 22 years, Broan has specialized in the production of Kitchen Ventilating Fans and Built-in, Electric, Fan-Type Heaters, and the study of requirements in the residential market.

Today, the complete line of Broan Kitchen Ventilating Fans fits every purse, with performance features that are unmatched in the entire industry — a line that leads kitchen-fan sales in several important markets, and enjoys the enthusiastic endorsement of contractors, builders and architects as well as home owners.

Outstanding Broan Features Make Sales Easier

The outer door of MOTORDOR Kitchen Fans, equipped with an extra motor, automatically opens and closes when the switch starts and stops the fan. This quality feature is a sure sales builder.

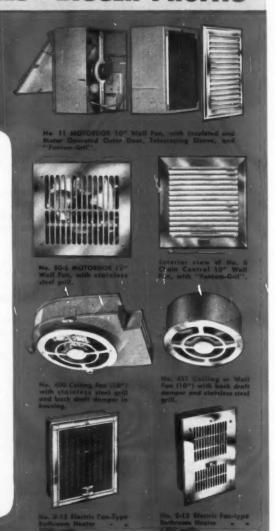
In addition . . . no other ventilating fan has the INSULATED OUTER DOOR, which, when closed, seals tightly against a sponge rubber gasket — positive protection against drafts, condensation, and rattling dampers — and standard equipment on ALL Broan Wall Fans.

The "FANTOM-GRIL", available in Chrome or White enamel, not only insures the most efficient air movement but also conceals the fan interior and adds beauty to the kitchen wall.

BROAN MFG. CO., I 1677 N. Water St.,	Milwaukee 2, Wis.
	Bigger Profits With Broam Electric Bathroom Heaters?
Name	
Company	W D* . A. 1974000000000000000000000000000000000000
Address	0 A X A Z X V MA MM X A G O NO C O C O C O C D D D D D D D D D D D D
City	Zone State

BROAN MFG. CO., INC.

1677 N. WATER STREET MILWAUKEE 2, WISCONSIN



APRIL at a Glance

AIR CONDITIONING—An industry wide survey conducted by *Electrical Construction and Maintenance* of current activities in air conditioning discloses the key role of the electrical contractor in this booming industry. It also indicates the potential of the electrical contractor as a marketing channel for air conditioning apparatus. The results of this research are presented graphically in a special report beginning on page 69.

Following the survey results is a unique Electrical Contractor's Air Conditioning Guide; the first time, we believe, that the methods and techniques of air conditioning have been prepared specifically for an audience whose primary training and experience are electrical. The guide covers operation, application, installation and maintenance of unit-type air conditioning apparatus.

FLUORESCENT MAINTENANCE-

The big swing to fluorescent lighting for schools inevitably brings the problems of systematic maintenance to hold minimum design levels of illumination with the best economy in replacement of lamps, starters and ballasts. A study of the methods employed by the Birmingham, Ala. school system is, therefore, particularly timely.

Birmingham's 86 schools are lighted

to better than 30 footcandles by 60,000 fluorescent lamps in continuous row louvered luminaires. They are maintained by a special maintenance crew which serves the entire school system. The story, "3-Man Crew Maintains School Lighting," begins on page 68.

CASE FOR 480/277—Interest in higher utilization voltage for commercial buildings is stimulated by the heavy fixed motor loads and higher levels of fluorescent lighting in contemporary commercial building design. The 480 volt Y system with 277 volts to ground offers a conventional 3 phase power voltage with a lighting voltage within the range of economical fluorescent lighting ballast design. Dry type transformers provide standard utilization voltage for receptacles or other uses as required.

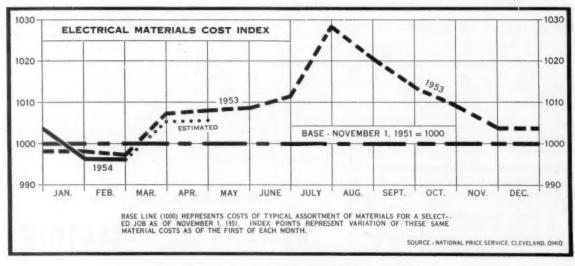
The case for 480/277 volt systems in large office buildings is presented by D. L. Beeman and H. D. Kurt of General Electric in a series of two articles, "Commercial High-Voltage Installations," beginning on page 94 in this issue.

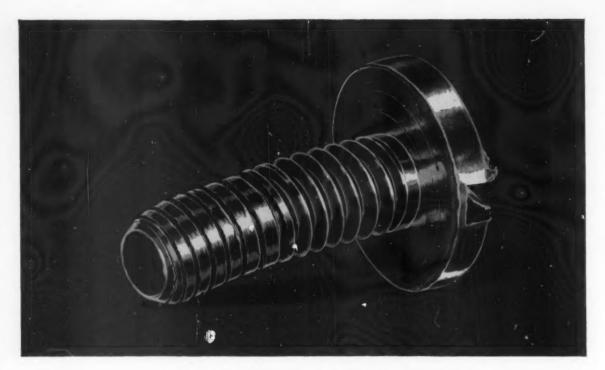
FT. WORTH AIRPORT—Travelers out of Texas have high praise for the new airport facilities at the Greater Ft. Worth International Airport. The recently completed work is distinctively modern and geared to an expanding age of air transport.

Eacking up the operation is an equally modern and well-planned electrical system installed by State Electric Co. of Ft. Worth. Fred R. Schmidt, president of State Electric, gives us an inside look at the wiring design and installation details in "Wiring A Modern Airport" beginning on page 88.

WIRING DETAILS—Some jobs have everything. One of those gems of electrical work is the recently completed research and development plant built for Marlin-Rockwell at Falconer, N. Y. Some of the features are an extensive bus and trolley duct system, better than 50 footcandle illumination, eight different frequencies for standard and hi-cycle service, several unique grounding methods, relay controls, low voltage switching circuits for higher voltage equipment, load center distribution and pilot light signalling.

The electrical work was installed by H-T Electric Co. of Perth Amboy, N. J. and engineered by Wigton-Abbott Corp. of Plainfield, N. J., whose chief electrical engineer, Ralph C. Hodges gives us a detailed account of the many special features of the electrical installation. His article "Distribution for Development" begins on page 63.





A cause of failure...now removed

New G-E wiring devices eliminate binding screws



HOW GE3800-LINE DEVICES WORK

Sturdy locking springs hold the entire stripped length of the wires securely inside contact channels as shown in the cutaway view above. These connections withstand a pull-out test of over 75 pounds with No. 14 Awg wire. Equally strong (and equally easy) connections are made with No. 12 and No. 10 Awg wires. Vibration won't loosen connections—yet, when necessary, the wires can be released by inserting a screw-driver in the release slots. All live parts are completely enclosed to avoid shocks and short circuits.

ASK YOUR G-E CONSTRUCTION MATERIALS DISTRIBUTOR

to demonstrate how GE3800-line outlets, switches, and lampholders with pressure-lock terminals provide

- . EASIER CONNECTIONS
- BETTER TERMINATION
- PROTECTION AGAINST BREAKAGE

- · Avoid stripped threads and breakage
- · Just push in the wires to connect

It's so easy to mangle binding screw threads when working with No. 12 or No. 10 Awg wire—and when this happens you usually have to scrap the whole device. Now you can prevent this waste by using the new GE3800-line outlets, switches, and lampholders with pressure-lock terminals. They have no binding screws—and they are amazingly easy to wire. You just strip the insulation off the wires and push them into the terminal holes. There are no screws to loosen or tighten . . . no looping or bending of wires . . . no danger of connections vibrating loose. These devices mount easily in the box because the wires run straight out of the back.

GE3800-line devices with pressure-lock terminals are available in both standard and intermediate grades. All are listed by Underwriters' Laboratories, Inc., and meet Federal Specifications. Write for a free folder on this new wiring development. Section D127A-418, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in_

GENERAL



ELECTRIC

"Do-it-yourself" Crisis

One day soon the electrical industry is going to have to face up to one of the toughest problems it ever tackled. The "do-it-yourself" people have discovered electric wiring.

Stop in at any of the new building supply-hardware emporiums that are springing up over the country and see what goes on. They are going after the business of the home owner who has become a week-end mechanic; maintaining, repairing and modernizing his own home. Their wares include outlet boxes, wiring devices, fixtures, wire, cable, conduit, panelboards and fittings.

This energy we handle in the electrical industry is so terribly dangerous that we put an electrician through years of training before he works alone. And then we follow him up with a skilled inspector to make sure he used the right materials and methods and installed his work safely.

The electrical contractor is required to know and to observe strict codes, ordinances and laws. In some towns he must be licensed or bonded. Such limitations are imposed to guard the public from the hazards of improperly installed electric wiring.

The "do-it-yourself" folks are serenely aloof from rules. They are uninhibited by either the Code or Ohm's Law. Installation methods depend solely on native ingenuity and handicraft. The few who will read books or observe instructions will quickly "improve" or "simplify" them to suit their own interpretation and knowledge.

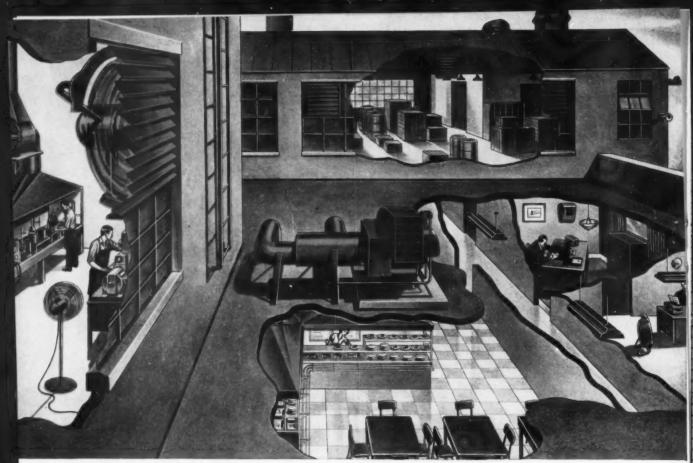
The deceptive simplicity of wiring materials and his little knowledge surround the home mechanic with a cloak of happy ignorance. He is further encouraged by how-to-do-it articles prepared by equally ignorant feature writers or by experts who do not realize that their instructions cannot convey their own background of knowledge and attitudes acquired through long experience.

We know how the home mechanic treats plug fuses and, with a little more ingenuity, tamper-resistant fuses and circuit breakers. The "troublesome" device is simply disabled or bridged. Do-it-yourself wiring gives him a much larger scope for his ingenuity. It does not alter his dangerous attitude.

The macabre suggestion that do-it-yourself wiring will double the electrical business—the job the amateur installs and the job the contractor installs after the fire—is too realistic to be amusing. To save pennies, perfectly well-intentioned men are taking unknowing risks with lives and fortunes at stake.

It is absurd to allow unskilled amateurs complete freedom in a craft where even top experts are bound by rigorous safety rules and regulations. Yet do-it-yourself wiring creates exactly that situation. Inevitably, limitations and controls must be imposed in the public interest. The initiative has got to come from within the electrical industry. Few others are even aware of the problem.

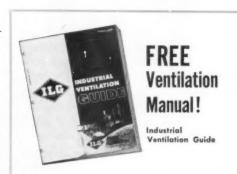
Wm. T. Stuart



NEED BETTER VENTILATION? Portable fans for spot cooling? Circulator and window fans for offices? Self-cooled propeller fans and universal blowers for large-volume circula-

tion? There's a Graybar-distributed unit specially designed to provide all the cool, refreshing air you want. And it's as handy to you as your nearest Graybar office.

Extra profits out of the air...via GRAYBAR



Get your FREE copy of this fact-filled manual today. It's packed with "How to" instructions for planning ventilating systems, curing the ills of present set-ups, figuring air change requirements, designing duct layouts, etc. Dozens of "right-way vs. wrong-way" illustrations. Write to the address below.

You can up your profits and, at the same time, increase production and lower costs for your customers with Graybar-planned ILG ventilating systems. Adequate ventilation equipment that removes fumes, dust, heat and stuffy air means better production all around. Check off these points and see what a big job fresh air can do.

- 1. Increases man-hour production
- 2. Reduces material spoilage
- 3. Cuts worker fatigue
- 4. Reduces accidents
- 5. Lowers labor turnover

Why not consider a free survey on your next job? Just call the Graybar office nearest you - we'll gladly work with you and your customer to find the best answer for his needs.

One thing that's good to remember, Graybar-distributed ILG fans and blowers are the best-designed and best-built units you can get. For that matter, Graybar is an all-inclusive source for everything electrical . . . over 100,000 quality items for wiring. lighting, communication, power, as well as ventilation.

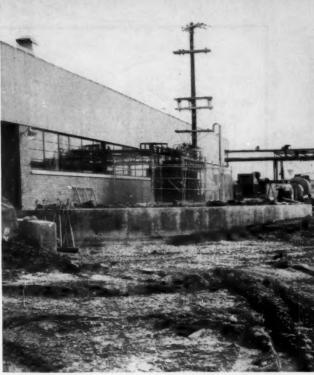
CALL GRAYBAR FIRST FOR ...

GraybaR ELECTRIC CO., INC.
420 Lexington Ave., New York 17, N. Y.





CONSTRUCTION VIEW shows use of plug-in and trolley duct, bar and chain hangers, column-mounted dry-type transformers, air conditioning units, narrow control panel-boards between column flanges, floor trenches and modern welding equipment.



OUTDOOR SUBSTATION now receives primary power at 4800-volts, although plans call for the future switch to 13.2-kv. All pole-mounted equipment is connected to coil-type ground directly beneath pole, while lightning arresters are connected to separate copper and pulverized carbon grounding pit.

Distribution for Development

Plug-in, trolley and underfloor duct, 50 footcandles of general illumination, extensive grounding, relay controls, low-voltage switching and high-cycle motors are features of Marlin-Rockwell's new research and development plant at Falconer, N. Y. Sound planning, good equipment and top-flight workmanship by the H-T Electric Company of Perth Amboy, N. J., added up to an installation of quality.

By Ralph C. Hodges

Chief Electrical Engineer, Wigton-Abbott Corp., Plainfield, N. J.

PROGRESSIVE installation techniques and practical concepts of design are effectively combined in the electrical distribution system serving the Marlin-Rockwell Corporation's new plant located at Falconer, New York. Engineered and erected by

Wigton-Abbott, with the H-T Electric Company of Perth Amboy, N. J., handling the electrical installation, the plant features an extensive busduct and trolley-duct installation, illumination in excess of 50 footcandles, eight different frequency levels for standard

and hi-cycle motor operation, several unique grounding methods and a wide variety of mounting ideas related to various lighting and distribution mediums. Relay controls, low-voltage switching circuits for the activation of higher-voltage equipment, ground detectors on branch busducts, load-center lighting transformers and a remote pilot-light signalling system are also highlights of this modern research and development center.

Primary power (4800 volts at present but planned as a future 13.2-kv service) is delivered to the property line via overhead pole line, then stepped to 480 volts at two separate outdoor transformer stations and carried into the main plant building and boiler house through weatherproof service heads. Poles supporting the overhead line are 45-foot Class 3 creosoted Southern pine, crib-braced with buried logs and rocks where changes in line direction occur, and additionally braced by head- and 2-way side-guys at frequent intermediary points. On

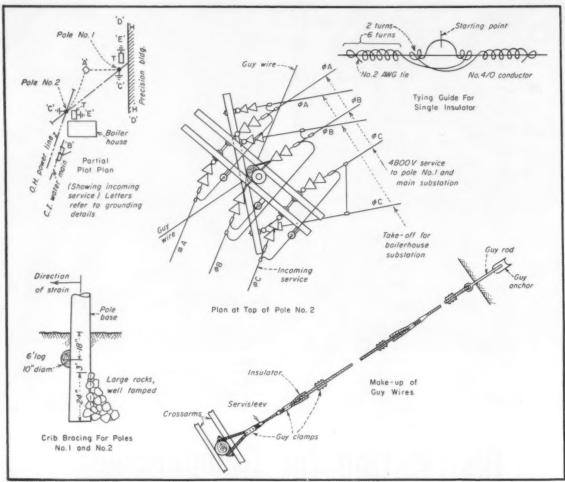


FIG. 1—Poles for primary service are guyed and crib-braced at terminal points and wherever changes in line direction occur. Methods used for securing conductors to insulators, guy cables to anchors and poles, and pole mounted equipment to grounding media comply with all recommended practices.

these poles, primary conductors are strung in a triangular pattern, phases A and C mounted at the ends of crossarms bolted $3\frac{1}{2}$ -feet below pole crowns, with phase B secured to insulators atop the poles proper. Conductors are secured to insulators by 6-foot lengths of fully annealed No. 2 copper wire which are wrapped, reversed and snubbed as indicated in Fig. 1.

Grounding Methods

Deion gap 6-kv lightning arresters at the tops of the two substation takeoff poles are connected by bare solid No. 6 cable to a remote grounding pit, while all other pole-mounted electrical equipment is connected to coiltype grounds buried directly beneath the poles themselves. This lightning arrester grounding pit consists of a serpentine mat arrangement, brazed at six crossing points, (Fig. 2) buried 5 feet below grade and covered with a 1-inch layer of pulverized carbon.

Aside from the sphere of polemounted equipment, several other grounding details merit attention, such as the grounding of sub-station fencing, structural columns in the two main plant buildings, and the plant's power distribution system. For these first two items, standard 10-foot Copperweld grounding rods are used, connected to substation fencing by means of bare 4/0 solid cable and GA connectors, and connected to structural steel by No. 4 bare stranded cable clamped to ground rods by GA connectors and brazed to both flanges of each H-column. Grounding of the power distribution system is to a 10inch city water main, on the street side of the meter, with bare stranded 300MCM cable secured at three separate points to the CI pipe by means of a bridle yoke, double-wrapped brazed cable ends and GX and GQ connectors. (Fig 2.)

Each outdoor substation combines

three single-phase 500-kva 4800/480volt oil-immersed self-cooled transformers. Primary connections are through 3 single-pole group-operated oil-type load-break switches fused for 400 amps at 15-kv, while secondary connections are through electrically operated 3-pole 2000-amp air circuit breakers having interrupting capacities of 75,000 amps. Transformed power at 480 volts is carried from these outdoor subs into the two main buildings by means of flatwise-mounted low-loss weatherproof 3-phase 3-wire busduct, passing through weatherheads and vapor-barrier wall flanges.

Busduct Framework

Distribution inside the main plant is also radial, the main stem of the system being a 2000-amp high-efficiency 480-volt busduct which (at the midpoint of the building, where total connected load on the system is approximately halved) is stepped through

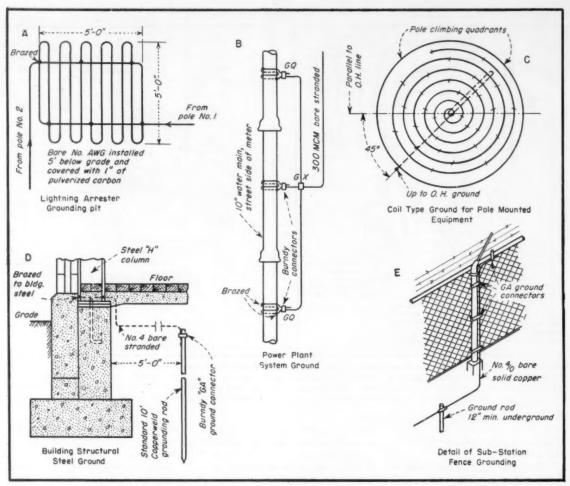


FIG. 2—Grounding media include (a) a carbon-blanketed copper mat for lightning protection, (b) a 3-point bridle yoke brazed to the water main as a ground for the power system, (c) buried coils for pole-mounted equipment, (d) driven Copperweld rods connected to structural columns via bare stranded cable and (e) a variety of clamping devices.

a breaker cubicle to a 1000-amp plugin busduct run. Fanning out from this central run to all sections of the structure are 600-, 400- and 225-amp plug-in runs, each branch protected by fusible adapter cubicles having Amptrap protection, and each branch also equipped with ground detectors.

These ground detectors operate with neon lamps placed in series between each phase bar and part at a resistor so that, under normal conditions, lamps remain constantly lighted, going out only when the system develops a ground and, resultingly, provides a current path having a lower resistance than that through the lamp.

Isolated sections of plug-in busduct, serving remote areas of the plant, obtain power through cable tap boxes, cable feeders run in conduit above the trusses or hung ceiling areas, and breaker cubicles plugged into the main busduct distribution line.

This comprehensive busduct frame-

work provides a flexible, convenient means for power delivery from main outdoor transformer substation to all points of consumption and, with closely-spaced plug-in stations, power can be taken off at any point desired so that rearrangement of equipment is possible at all times without effecting major revisions in the primary system. Moreover, current is conveniently available for all motors, lighting and heating equipment; the system is easy to install; it is almost completely salvageable; it provides maximum safety, and requires a minimum amount of maintenance.

Depending upon location, busduct runs are mounted either edgewise or flatwise, secured to walls by means of angle irons and brackets, suspended from the ceiling by means of flat iron straps or cradle type hangers, held by cantilever hangers and sway-braced by angles or rods wherever required. In testing sections of the plant where

parallel lighting troffers support intermediate areas of asbestos ceiling board, plug-in busduct runs are positioned between troffers, close to this ceiling surface, and are supported by means of cantilever hangers and short threaded rods that terminate in couplings welded to angle-iron Smitheraft yokes spanning adjacent troffers. (Fig. 3.)

Plug-in busduct is also used to distribute direct (in addition to alternating) current, these busduct runs being powered through double-pole double throw fusible safety switches, cables in conduit and end cable tap boxes. This 125-volt power is obtained from two 75-kw generators which are linked to 115-hp 3-phase motors, compensator-connected to one of the 440-volt 3-wire ac plug-in busduct branches. (Fig. 4.)

In addition to these aforementioned weatherproof, low-impedance highefficiency, and plug-in busduct installa-

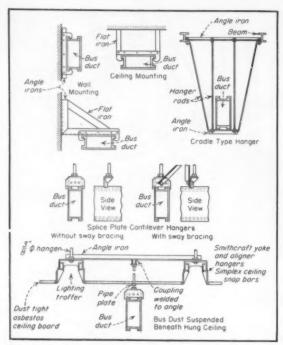


FIG. 3—Busduct is mounted along wall and column lines, also suspended from ceilings, beams and angle bridges by means of a variety of clamps, trapeze straps, rod hangers, sway braces and welded couplings as indicated above.

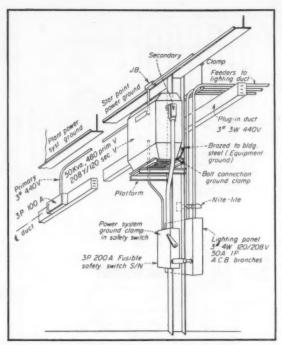


FIG. 4—Lighting transformers are platform-mounted to structural H-columns at load centers, with primaries connected through plug-in breakers to 440-volt ducts, and 208Y/120-volt secondaries dropping down to 3-phase 4-wire panels.

tions, three other duct systems are utilized. These include trolley, underfloor and square.

Trolley duct is used primarily in connection with lighting, with ducts suspended either (1) directly from roof purlins by means of hangers, rods and Kindorf clamps or (2) by sway braces clamped to angle irons welded at right angles to overhead beams. (Fig. 5). Underfloor ducts are 2-cell, installed according to standard practice for the distribution of low-potential telephone and communication wiring, and of 110-volt power required for office equipment.

The square (6-by-6-inch) duct is used to conduct all circuit wiring between a frequency-converter room and two banks of six high-speed grinding machines. Duct sections, tees, elbows and accessory fittings in this installation are bonded together with brazed copper braid (tinned) in order to establish electrical continuity to the system ground. Connections between the square duct and the various machines are via short nipples, gangmounted aluminum polarized receptacle boxes, and heavy-duty flexible cable leads:

These high-speed grinding machines are of particular interest, inasmuch as they are equipped with replaceable spindle head motors, each motor designed to operate at a different speed and, consequently, requiring a different current frequency. Although each of the 12 grinders can be adapted for 7 frequencies, only 4 receptacles per machine are now installed, so a selection is required of company engineers as to which 4 of the available 7 frequencies are tapped at each location.

Current for lighting is obtained through a series of 50-kva dry-type transformers, column-n ounted at local load-center points throughout the structure. (Fig. 6.) Primary power is provided from the 440-volt plug-in system, takeoff being made through 100-amp 3-pole safety devices. Transformer secondaries (120/208-v) drop to fused safety switches, then into the ACB-equipped control panels and up again to truss level where branch feeders are carried to lighting ducts. Grounding at transformer locations is three-fold; the star point of the secondary, also the safety switch, being connected to the power system ground, and the transformer case and platform grounded via brazed braid to the building column which, in turn, is grounded at the base as already discussed. (Fig. 2.)

In connection with these transformers, it should also be mentioned that control circuits for all ac motors are 120-volts, thereby eliminating the pos-

sibility of operating personnel coming in contact with higher voltages at control points.

In all instances, wiring reveals strict adherence to recommended practices. For example, all conduit is zinc-coated inside and out, securely fastened on centers of 5 feet or less, and sealed at all outlets during the installation period by bushettes to prevent the entrance of foreign matter. Each conduit is fastened to the building independently—never to another pipe or conduit.

Fixture Mounting Methods

Lighting fixtures within the main building are primarily fluorescent, containing either two or three 4- or 8-foot lamps, and mounted singly or in continuous rows depending upon location and required illumination levels. Where units are used in open truss sections, they are suspended either by conduit hangers from the branch conduit runs themselves, or are chain-suspended from trolley ducts.

Lighting branch circuit conduits and trolley ducts alike are run either parallel or at right angles to roof purlins, conduits being secured by beam clamps, while trolley ducts are supported either by rod hangers or sway bracing. (Fig. 5) Since conduit hangers are equipped with hooks and 2-pole receptacles for plug-in flexible

leads, fixtures may easily be disconnected, taken down for maintenance or relamping, then replaced. The use of trolley duct, of course, results in maximum flexibility for placement or shifting of fixtures in accordance with local lighting requirements.

In seven separate interior areas, fluorescent illumination is provided by continuous troffers, with dust-tight asbestos insulated metal acoustical ceiling panels extending between troffers. (Fig. 3) Mounting of troffers and ceiling panels is by means of Smitheraft track installations, tracks running from wall to wall and supported at wall lines by standard angle irons. Intermediate tracks have Zshaped return edges to receive ceiling panels independently of any other support so as to permit the installation of the lighting troffers either before or after the installation of the ceiling.

Troffers are variously equipped with louvers, Controlenses or Skytex glass panels. Lamps in these units are either standard or deluxe warm white, and fixtures are equipped with high powerfactor ballasts and manually-reset Watchdog starters.

In the main lobby, the lighting plan incorporates a 20-foot long 6-inch deep troffer, shielding cold-cathode 4500-degree white lamps operating through a 7500-volt transformer.

Exterior illumination consists essentially of weatherproof floodlight units mounted along building parapets, at corners, over doorways, around parking areas, along roadways, at the spray pond and transformer stations. All outdoor units are equipped with 500-watt incandescent reflector type lamps, units mounted either singly or in clusters of three. (Fig. 8)

Other electrical features of this installation include two separate air-conditioning systems, pilot-light signalling, an impulse-regulated clock system, complete centralized sound distribution and paging system, and a 100-line PBX telephone installation.

The air-conditioning units have a combined compressor capacity of 620-hp and the system incorporates thermal and disconnect switches for exhaust, cooling, heating and ventilation.

The pilot-light signal installation informs supervisory personnel of conditions at the spray pond (high or low level); air filters, attic lighting, paging amplifiers (on-off), plus lobby and fire doors (open-closed).

Also installed for plant protection is a closed-circuit code-ringing electrically-supervised break-glass fire alarm system, and a 30-station watchman's tour 48-hour recorder.

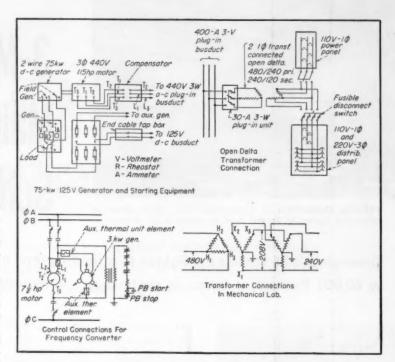


FIG. 5—Power distribution is radial from one main 2000-amp 440-volt ac busduct feeder, yet the demand for eight different frequencies, several lower utilization voltages, plus direct current, dictated the adoption of several unusual connection plans for transformers, generators and converters.

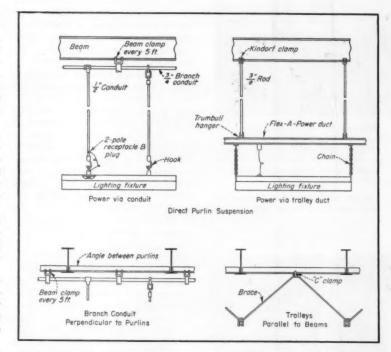


FIG. 6—Lighting fixtures are mounted both parallel and at right angles to purlins, suspended either directly from branch conduits or from trolley duct by means of conduit hangers, rods or chains. These several installation methods incorporate the use of beam clamps, disconnecting hooks, special plug receptacles and sway bracing as here illustrated.



TYPICAL CLASSROOM of Birmingham, Ala., school system is fluorescent lighted to lighting level in excess of 30 footcandles.

3-Man Crew Maintains School Lighting

Birmingham's 86 schools are lighted to a lighting level of more than 30 footcandles by 60,000 fluorescent lamps in continuous row louvered luminaires.



PORTABLE PLATFORM used by maintenance crew has rubber casters, straddles desks. Crew cleans luminaires with vacuum cleaner, then washes units and lamps. Defective components are replaced.

LAMPS, STARTERS and ballasts are shop tested, and reused in warehouse or other areas when not defective. L. R. Judy, electrical department head, is shown testing a fluorescent lamp.



LUORESCENT lighting systems in schools require planned maintenance, if minimum standard levels of illumination intensity are to be maintained, and if lamp, starter and ballast replacement costs are to be kept low.

That is the experience of the city school system in Birmingham, Alabama, which did a lot of experimenting on maintenance procedure before adopting its present system. A special threeman crew is now responsible for lighting maintenance in all schools of the Birmingham public school system.

Fred L. Kelly, manager of the school system business department, says that when the new fluorescent lighting system was first installed, no provision had been made for its maintenance by an outside electrical contractor or other maintenance service. Thus, in the beginning lighting maintenance was left up to the custodian of each school building as had been the case with the old incandescent lighting system. This included cleaning of the luminaires and lamps, and making replacement, when needed, of lamps, starters, and ballasts.

Maintenance by this procedure did not work out very well because lighting intensities were not maintained, and there was excessive use of lamps, starters and ballasts. Also, on many occasions an electrician had to make a special trip for repairs. For these reasons it was finally decided to pass on the responsibility for lighting maintenance to the school system electrical department, headed up by L. R. Judy.

The procedure now followed is to have an electrical maintenance man and two helpers to service the schools in rotation. This three-man crew inspects all lighting equipment. Any luminaires or parts found defective are replaced, or returned to the electrical shop for testing and repair. The two helpers first vacuum clean all luminaires to remove dust and dirt, then wash the luminaires and lamps.

The three-man maintenance crew requires about two days to complete a school. It works on primary and elementary grade schools during the school year while classes are in session, and on high schools during the summer vacation period. The crew uses a portable platform mounted on rubber casters which is adjusted so that it rides in the aisles, straddling the desks. There is no interference with class work.

There are 86 schools in the Birmingham school system, with 215 school buildings and two administration office buildings. Classrooms are 22 by 30 feet, 22 by 40 feet, and a few 25 by 25 feet in older buildings. Individual classrooms are lighted by two continuous rows of 2-lamp fluorescent louvered units having luminous sides, spaced to provide a fairly even distribution of light. There are in excess of 60,000 fluorescent lamps installed in the entire school system. These luminaires provide a minimum lighting intensity of 30 footcandles maintained. but in most cases the intensity averages from 35 to 40 footcandles. The long range program is to install a middle continuous row of luminaires in each classroom, which it is expected will bring the average intensity up to 50 footcandles.

What's in Air Conditioning for Electrical Contractors

A special editorial report on the electrical contractor's role in air conditioning with a guide to operation, application, installation and maintenance of air conditioning systems.

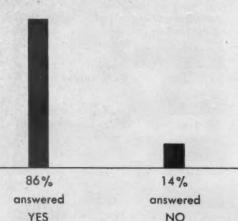
WHAT is the scope of the electrical contractor's job in air conditioning? What can he do? What facilities can he provide? What are his plans? In the booming air conditioning industry, the answers can be critically important. The application, installation and servicing of air conditioning equipment involves an elaborate technology. Of all available resources, the technical competence and service facilities of electrical contractors are the most quickly available and adaptable to the task.

To study the situation quantitatively Electrical Construction and Maintenance developed a research study of the present state of electrical contractor participation in the air conditioning field. The survey was conducted over a random sample of 3,000 electrical contractors. This report is derived from the results.

On the pages following this statistical analysis of electrical contractor participation in the air conditioning industry, we present a unique report on the technology of air conditioning. Covering operation, application, installation and maintenance of air conditioning equipment, this report has been prepared specifically for men whose background and training are primarily electrical.

DO ELECTRICAL CONTRACTORS HANDLE AIR CONDITIONING WORK?

Q. During 1953 did you or your company have anything to do with sales, installation, and/or wiring for air conditioning equipment?

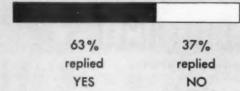


WHAT KINDS OF WORK?

- Q. If YES above, how would you classify your activities in relation to air conditioning?
 - 96% provided electrical wiring and connections
 - 33% installed air conditioning equipment
 - 26% repaired and serviced equipment
 - 23% sold air conditioning equipment
 - 9% provided engineering and design service for complete air conditioning systems

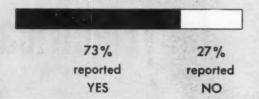
ANY EXPANSION PLANNED?

Q. Are you planning to expand your business interests in air conditioning?



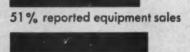
ANY SUB-CONTRACTING INVOLVED?

Q. Do you regularly perform electrical work or other installation details for another contractor, dealer, agent, or firm engaged in the sale and/or installation of air conditioning equipment?

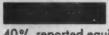


WHAT KINDS OF EXPANSION?

Q. If YES, above in which of the following ways?



54% reported equipment installation



40% reported equipment repair and maintenance

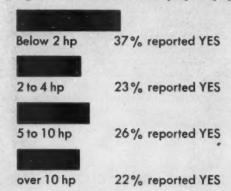


20% reported system design service



APPLICATION KNOW-HOW?

Q. Are you or others in your company qualified by experience or training to estimate air conditioning loads and to recommend proper equipment?



HOW MUCH EXPERIENCE?

Q. For how many years have you or your company handled work related to air conditioning installations?



24% reported over 10 years experience

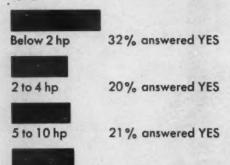


17% reported 6-9 years experience

43% reported 1-5 years experience

QUALIFIED INSTALLATION PERSONNEL?

Q. Does your company have personnel capable of expertly installing and servicing air conditioning equipment?

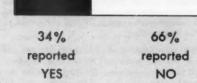


22% answered YES

over 10 hp

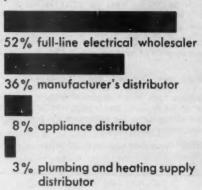
CUSTOMER RECOGNITION?

Q. Are you identified in your community through advertising, promotion, display, telephone directory listings, or by reputation as equipped to sell, install, or service air conditioning equipment?



PURCHASING PREFERENCES?

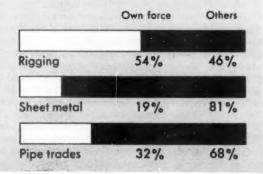
Q. From what source of supply would you prefer to buy air conditioning equipment and accessories for resale?



1% other

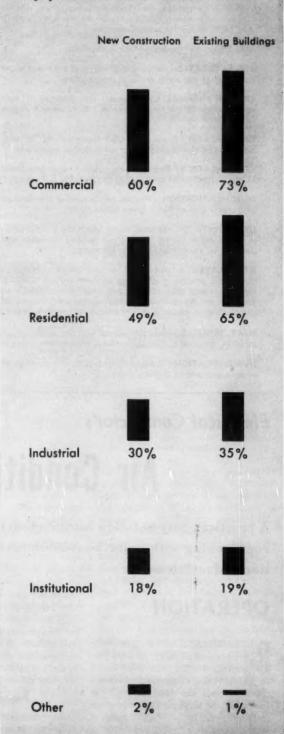
HOW ABOUT NON-ELECTRICAL WORK?

Q. For each of the following classes of work on air conditioning installations do you use your own labor force or the services of other contractors?



WHAT CLASSES OF BUILDINGS?

Q. In which of the following classes did you or your company sell, install, or wire for air conditioning equipment?



Vocabulary of Air Conditioning

The following definitions are presented to afford a practical understanding of the nomenclature commonly used to describe the equipment principles and processes of air conditioning.

AIR CONDITIONING as it applies to the furnishing of human comfort is the process of simultaneously maintaining within certain specified limits the temperature, relative humidity, movement, and quality of air in such spaces as may be intended for human occupancy.

AIR, DRY: Air containing no water vapor.

AIR, SATURATED: Mixture of dry air and saturated water vapor, all of the same dry bulb temperature.

BRITISH THERMAL UNIT (Btu): The quantity of heat required to raise the temperature of 1 lb of water 1 degree Fahrenheit.

CONDENSATE: Water extracted from air, as by condensation on the cooling cail of refrigeration equipment.

CONDENSATION: Process of changing a vapor into liquid by the extraction of heat.

DEHUMIDIFICATION: Process of decreasing the amount of water vapor within a given space.

DEW POINT: The temperature at which the condensation of water vapor begins for a given relative humidity and pressure as the temperature is decreased.

HEAT, LATENT: Heat added or taken from a substance during the process of changing its form (vapor to liquid, liquid to vapor, etc.). The "latent heat" transmitted from the skin to the surrounding air during evaporation of perspiration is responsible for producing comfort.

HEAT, SENSIBLE: Heat considered only by virtue of its intensity as measured by a standard thermometer.

HUMIDIFICATION: Process of increasing the quantity of water vapor within a given space.

HUMIDITY, RELATIVE: Ratio of the water vapor pressure in a given space to the maximum water vapor pressure that could exist at saturation at the same temperature, expressed as a percentage.

PLENUM CHAMBER: An air compartment, such as at the discharge end of a pressure-type air conditioner or warm air furnace, maintained at a pressure and connected to one or more distributing ducts.

PSYCHROMETER: Instrument used to ascertain the amount of water vapor in the air. It consists of two thermometers, one reading wet bulb temperatures, the other reading dry bulb temperatures. The wet bulb thermometer has its bulb wrapped in a water-saturated wick. The two thermometers are usually mounted on a handle and rotated rapidly in the air to be measured. Water evaporating from the wick removes heat from the air, making the wet bulb thermometer read lower than the dry bulb. The difference between the two readings is used (with the aid of a psychometric chart) to determine the relative humidity. The greater the differential, the lower the relative humidity. If the two readings were identical, the relative humidity would be 100%. Since the air is holding all the water vapor it can hold, no moisture would be evaporated from the wick.

REFRIGERANT: Substance which produces a refrigerating effect by its absorption of heat while expanding or vaporizing.

TEMPERATURE, DRY AND WET BULB: See Psychrometer.

VAPOR: Gaseous form of substances which are normally in the solid or liquid state and which can be changed back to these states either by increasing the pressure or decreasing the temperature.

VENTILATION: Process of supplying or removing air to or from any space.

Electrical Contractor's

Air Conditioning Guide

A practical, easy-to-follow introduction to the methods and techniques of modern air conditioning with unit-type conditioners, covering operation, application, installation and maintenance

OPERATION

REFRIGERATION is essentially the removal of heat. In food preserving, it is the heat which enters the refrigerating compartment through cracks around the door, through the insulation, or through the door when it is opened. In air conditioning it is the unwanted heat existing in a

space intended for human occupancy. Air conditioners employ refrigerating equipment very similar to that used in food-preserving applications. Basic components of the compression-type refrigeration system are the refrigerant, evaporator, compressor, restrictor, and condenser.

Refrigeration Cycle

A refrigeration system depends upon the evaporation of the refrig-

erant for the removal of heat. Evaporation is brought about by the boiling of the refrigerant, a liquid which inherently has a very low boiling point. Evaporation changes the liquid to a vapor, a process which absorbs heat from the immediate surroundings and accomplishes the desired cooling. By keeping the refrigerant in an entirely closed system, the vapor is changed back to a liquid to replace that which has evaporated.

Since evaporation is fundamentally the escape of moving molecules from the surface of the liquid, the rate of evaporation can be materially increased if the air molecules directly above the surface of the liquid are removed, thus reducing the collisions between gas and air molecules and decreasing the number of gas molecules which are deflected by these collisions back into the liquid. Removal of the air molecules is accomplished by the use of a compressor, which produces a partial vacuum or suction above the liquid. This vacuum is primarily responsible for the vaporization of the refrigerant; the reduction in pressure lowers the boiling point so that boiling is facilitated at existing temperatures.

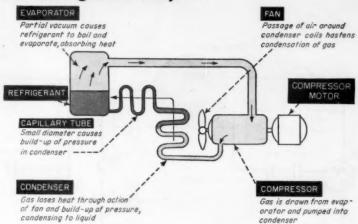
The pumping action of the compressor directs the gas through a coiled tube called the condenser. Its function, as its name implies, is to condense the gas back into a liquid. The motor which drives the compressor may also drive a fan, the blast of air from which cools the gas inside the condenser. The removal of heat from the gas causes it to condense into a liquid.

Since a low pressure facilitates boiling, it follows that a high pressure will speed up condensation. Since both a high pressure and a low pressure cannot exist throughout the system at the same time, provision must be made to create a high pressure in the condenser and a low pressure in the evaporator. This is accomplished by retarding the flow of refrigerant between the condenser and the evaporator with some type of restrictor, the simplest of which is a capillary tube. This small-diameter tube offers resistance to the flow of the refrigerant on its way to the evaporator, causing it to pile up at the entrance of the restrictor. The compressor keeps pumping liquid into the condenser tubing, resulting in a build-up in pressure there. Liquid enters the evaporator at a slow rate, enabling the evaporator pressure to remain comparatively low.

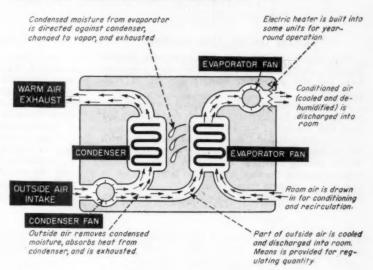
Application to Air Conditioning

Air conditioners containing such refrigerating mechanisms draw in warm air by means of fans, remove a certain amount of its heat as it passes through the evaporator, and direct the cooled air into the space being conditioned. Air conditioning implies, in addition to the cooling of the air, its filtering, dehumidification and circulation, as well as ventilation of the conditioner are those described above, with certain modifications and additions.

The Refrigeration Cycle



The Air-Cooled Conditioner



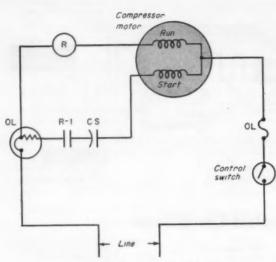
Refrigerant: Most commonly used refrigerants for unit air conditioners are Freon-12 and Freon-22. Freon is more satisfactory than previously-used refrigerants because it is neither flammable nor toxic, and it is noncorrosive when used with most common metals. Its boiling point at atmospheric pressure is in the neighborhood of —20 degrees Fahrenheit.

Evaporator and Condenser: These units are similarly constructed of copper tubing with aluminum-finned surfaces, presenting a large face area to the air stream and creating maximum turbulence. Heat is removed from the condenser by the air stream of a fan in air-cooled units and by the circulation of water through plain or finned tubes in water-cooled units. The "evaporative" condenser is cooled by the action of a water spray and a fan.

As warm, moist room air to be cooled passes across the evaporator, some of its moisture is condensed on the evaporator coils. This removal of moisture from the air accomplishes the function of dehumidification. In smaller conditioners, the moisture drips from the coils to a pan. A "slinger" ring attached to the periphery of the fan blades dips into the pan as it rotates and sprays the moisture into the air stream of the fan and against the hot condenser, where it is vaporized and removed with the hot air. In other units the moisture may be carried by means of tubing from the evaporator to the condenser and vaporized. Moisture from large water-cooled units is directed into a drain, separate from the one for cooling water disposal.

Compressor: Unit air conditioners using Freon as the refrigerant usually

Electrical Schematic Control Diagrams for



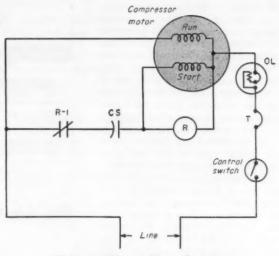
Current (Series) Type Starting

High starting current (3 to 4 times running current) energizes relay coil R, closing normally-open relay contacts R-1 and connecting starting winding of compressor motor.

When approximately 80% full speed is reached, current through R has decreased so much that contacts R-1 open and disconnect starting circuit.

Three-wire overload cutout OL is bimetal disc with built-in heater, protecting compressor motor against excessive starting currents. Located in close proximity with compressor housing, cutout also breaks circuit in

CS is the starting capacitor for the compressor motor.



Voltage (Shunt) Type Starting

At starting, both starting and running windings are energized, but voltage across relay R is too low to open normally-closed contacts R-1.

As motor comes up to speed, voltage across R increases until, at about 80% full speed, contacts R-1 open, disconnecting starting circuit.

During running period, voltage induced in starting winding is enough to keep R energized and hold contacts R-1 open.

Thermostat T is usually placed in circuit to control only the compressor motor.

Two-wire cutout OL protects compressor motor against high starting currents and high temperatures.

incorporate a hermetically sealed reciprocating compressor. Motor, refrigerant, compressor, and lubricating oil are built into the same housing without gaskets or fittings to provide maximum protection against leakage of the refrigerant. The nature and consistency of the oil are such that the oil and refrigerant do not combine.

case of high running temperature.

Restrictor: Capillary tubes are used in small conditioners to accomplish the necessary increase of pressure in the condenser. The bore of the tube (in the order of 1/20-inch diameter) and its total length determine the evaporator pressure, hence it is not possible to vary this pressure in accordance with changes in temperature and humidity. Such adjustment is important, since the power required by the compressor to do a given amount of work is directly related to the evaporator pressure and temperature. Accordingly, larger units use some type of expansion valve to maintain constant pressure and temperature in the evaporator regardless of outside conditions.

Fans: The flow of air through the conditioner is accomplished by the use of one or more fans. Since the compressor is usually hermetically sealed, its motor does not drive a fan. Where only one fan is used, it functions both to discharge air through the evaporator into the room and to exhaust warm air.

Larger units employ both a condenser fan and an evaporator fan. The condenser fan draws outside air into the unit and directs it through the condenser and back outside, carrying the heat and moisture from the condenser. Part of this outside air, instead of going to the condenser, is usually channeled through the evaporator and into the room to accomplish ventilation. Since water-cooled units employ water to carry away the heat, they do not have a condenser fan.

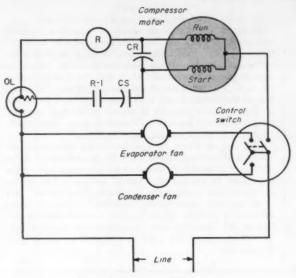
Condenser fans are usually of the propeller-blade type, while evaporator fans are of centrifugal or "squirrelcage" design. Both fans may be operated by the same motor.

Filters: Both the air recirculated from the room and that brought in from the outside pass through some type of filter (Fiberglas, hair, paper, etc.) on the way to the evaporator so that such impurities as dirt, dust, soot and pollen may be removed. Smaller units use throw-away filters; others contain re-usable permanent types.

Electrical Components

Compressor Motor: Hermetically sealed within the compressor housing, the motor is usually a capacitor-start type with running and starting windings, rated at ½ hp and higher. A protective overload device may or may not be built into the motor. The unit's control circuit makes provision for cutting out the starting winding when the motor has come up to speed. A room conditioner requiring a 1-hp motor often uses two of ½-hp rating, each with its own evaporator and con-

Room and Self-Contained Air Conditioning Units



Manual Sequential Starting

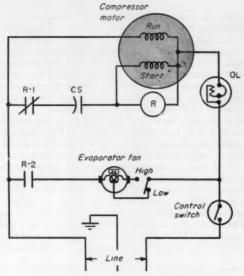
Turning control switch from OFF to first position starts condenser fan motor; second position starts compressor and evaporator fan motors.

Initial current through relay coil R is high, causing normally-open contacts R-1 to close, which connects starting circuit.

As motor comes up to speed, current through R drops, opening contacts R-1 and starting circuit.

A final position of the switch may disconnect compressor and condenser fan and connect only the evaporator fan for ventilation.

A running capacitor CR is often used to improve the power factor and reduce the full-load current.



Automatic Sequential Starting

At starting, both starting and running windings are energized, but voltage across relay R is too low to operate relay contacts.

As motor comes up to speed, voltage across R increases until, at about 80% full speed, normally-closed contacts R-1 open, disconnecting starting circuit and closing contacts R-2. This starts evaporator fan motor.

During running period, voltage induced in start winding is enough to keep R energized and hold relay contacts operated.

Air discharge fan (evaporator fan) is shown with a split winding for high and low speed operation, controlled by separate High-Low selector switch.

denser, to permit them to be started separately and thus reduce the otherwise high starting current.

Fan Motors: Single- or two-speed shaded pole induction motors with built-in thermal overload protection are usually used to drive the condenser fan and evaporator fans. The two-speed motor has a two-circuit running winding for high and low speeds.

Starting Relays: The starting winding of the compressor motor is usually cut out of the circuit by means of a relay. Two types of relays are generally used: the current type, connected in series with the running winding of the motor, and the voltage type, connected in parallel with the start winding. Larger units may use multiple-contact relays to enable starting the motors in sequence automatically to reduce the initial starting current.

Temperature Controls: Utilities in certain areas do not permit the use of a thermostat to start and stop air conditioning equipment, since the fre-

quency of starting often taxes the electrical system, sometimes introducing flicker into lighting circuits. Accordingly, conditioning units are available with or without thermostats. They may be purchased as accessories where they are not built in. The thermostat makes more efficient operation possible, being of chief value in keeping the temperature from falling too low when there is a drop in outside temperature. The thermostat usually controls only the compressor motor.

Another approach to temperature control without the disadvantage of frequent starting and stopping is through the limitation of refrigerant activity. Operation of a thermostat energizes a heater located so that its heat is imparted to the refrigerant. The resulting formation of bubbles in the refrigerant reduces the amount entering the evaporator, with a consequent reduction in evaporation.

Overload Protectors: Fan motors have built-in thermal protectors, but

protection for the larger compressor motors is usually located outside the hermetic unit. Two types are in common use. Each usually consists of a bimetal disc and heater element; the difference lies in the method of connection in the circuit. The two-wire protector has its bimetal disc and heater in series. The disc heats up and snaps open in the event of an abnormally high current. The three-wire protector has its heater in series with the compressor motor start winding, heating the bimetal disc in case of excessive current during starting. During the running period the bimetal disc, which is in series with the line and located in close proximity with the compressor housing, snaps open and breaks the circuit at high temperatures.

In addition, water-cooled units incorporate a high pressure cut-out mechanism to protect the system against high refrigerant pressures should there be a failure or substantial reduction in the water supply.

A Ton of Refrigeration

Since the primary function of any refrigerating or air conditioning unit is the transfer of heat, it is logical to rate the unit according to the quantity of heat it is able to remove from the space to be refrigerated or conditioned. The fundamental unit of heat, the Btu, is too small for practical use; so a larger unit, called the standard commercial ton of refrigeration, has been adopted and defined as "the number of Btu required to freeze one ton of water at 32F into ice at 32F in 24 hours."

It is necessary to remove 144 Btu from one pound of water at 32F to turn it into ice at 32F. Therefore a ton, or 2,000 pounds, of water would require the removal of 2,000 × 144, or 288,000 Btu. It is necessary for the period of time involved to be specified, since the time required to accomplish a given amount of cooling is a measure of the unit's performance. Removal of 288,000 Btu in a 24-hour period is equivalent to a constant removal rate of 200 Btu per minute or 12,000 Btu per hour.

Thus a 1-ton air conditioning unit would be capable of removing 12,000 Btu per hour from the conditioned space; a rating of 6,000 Btu per hour would indicate a

½-ton unit; 4,000 Btu per hour a ½-ton unit, etc.

However, the ability of a unit to remove a specified number of Btu per hour depends upon the rate of evaporation of the refrigerant, which is in turn dependent upon certain mechanical characteristics of the compressor (speed, bore, stroke, etc.), and the type of restrictor used. The efficiency of the compressor and the operation of the restrictor vary with temperature and humidity, so that a unit's capacity is always rated at a specified temperature and humidity. Variations from these conditions will result in varying unit capacities.

The use of Freon in a reciprocating compressor requires a theoretical expenditure of approximately 1 hp per ton of refrigeration; therefore a 1-hp compressor motor is required to accomplish 1 ton of cooling, a \(\frac{1}{2}\)-hp motor is required for \(\frac{1}{2}\)- ton, etc. The terms "horsepower" and "ton" are not synonymous; theoretical values are never achieved in practice. However, they are equivalent in this case in the sense that the compressor size required may be adjudged from the tons of refrigeration which must be provided.

APPLICATION

NIT-TYPE air conditioners (to be distinguished from field-assembled air-conditioning equipment used in large central systems) are factorymade internally integrated, unitized assemblies which accomplish the complete process of air conditioning. Although unit-type conditioners can be applied in multiple to any size of air conditioning job, they are usually restricted to applications requiring small or moderate air conditioning capacities. For applications requiring more than 40 tons of refrigeration capacity, central system air conditioning installations offer more advantages. However, unitary equipment does find multiple application in high capacity installations where zoning of conditioned areas is desired or where ducts cannot be readily installed.

Types of Units

Unitary air conditioning equipment may be divided into two basic types, described as follows:

- 1. Room Conditioners-
- in capacities of less than 1½ tons;
 for installation in the conditioned area (in windows, in front of windows or through outside walls);
- deliver conditioned air directly to conditioned areas (no ducts);
- contain one or more condensing units and means for ventilation, air circulation and cleaning, cooling and dehumidification;
- with few exceptions have air-cooled condensers (require no piping);

- may contain electric heaters for winter use;
- available in window or console types. II. Self-Contained Conditioners—
- in capacities of $1\frac{1}{2}$, 2, 3, 5, $7\frac{1}{2}$ and 10 tons (some larger); for installation in or outside of the conditioned area;
- can be used for free delivery of air or with distribution ducts:
- contain one or more condensing units or refrigeration units and means for ventilation, air circulation and cleaning, cooling, dehumidification and temperature control;
- have water-cooled condensers (some of the 2 and 3 ton units are air-cooled);
- may have provisions for heating and humidifying or may be adapted to use in conjunction with warm air furnaces.

Of course, these classifications are not absolutely rigid. There is some overlap of characteristics of the two types.

Cooling Load

Selection of the proper type, size and number of units for any air conditioning job begins with calculation of the required cooling capacity of the equipment. Explanation of detailed and rigorous calculations of cooling load is given in the "Heating and Air Conditioning Guide" of the American Society of Heating and Ventilating Engineers. However, in the application of unit type conditioners, the requirements of comfort air conditioning (no need for specific or critical conditions of temperature or humidity)

are easily estimated by a minimum of simple calculations. For both room conditioners and self-contained conditioners, the various manufacturers make available practical, easy-to-use cooling load estimate forms. The Air Conditioning and Refrigeration Institute has developed such forms for the two types of unit conditioners. These forms, reproduced and explained on the following pages, are easily filled out and provide completely satisfactory accuracy of calculation for air conditioning of small or large rooms, stores, restaurants, office areas, individual residences and a wide range of other one,- two- or three-level areas.

Solution of a cooling load estimate form yields a total required cooling capacity in Btu per hour. This total divided by 12,000 gives the required capacity of air conditioning equipment in tons of refrigeration. A unit or units, with capacity equal to or greater than this load must be applied. The determination of required cooling capacity, however, is only the first step in the selection process; although the other selection factors are modified by the required capacity.

If the total estimated cooling load for a particular job is less than 18,000 Btu per hour, a single room air conditioner will satisfy the requirements. If, however, the required capacity is more than 18,000 Btu per hour, either multiple room units or one or more self-contained units must be selected. In such cases, application of a single

		7			VOL	TAC	GE I	RATI	NGS	AV	AIL	ABLI				
UNIT				6	0 Cy	cle						50	Cyc	le		
SIZE	1-	-Pho	se	2-P	hase		3-P	has	e	1-	Pha	e	3	-Pho	ase	
HP	115	208	230	220	440	208	220	440	550	100	200	230	208	220	380	440
1/3	Х									Х						
1/2	X	X	X							Х	X					
3/4	X	X	X							Х	X					
1		X	X								X	X				
11/2		X	X													
2			X	X	X	X	X	X	X						X	X
3			X	X	Х	х	X	,X	X				Х	X	Х	X
5				Х	X	X	X	X	Х				Х	Х	Х	X
71/2			X			X	X	X	Х				X	X	X	X

CROSS-REFERENCE DATA on electrical specifications of unit-type conditioners shows available voltage, phase and frequency ratings for various sizes.

unit or a minimum number of units will generally be most economical. But particular conditions on any job requiring more than 18,000 Btu per hour capacity will usually determine the number and types of units to be used to get the necessary capacity. Typical considerations which might resolve this problem are as follows:

Where the season of peak cooling requirements is short, multiple units may offer advantage over a single unit. In such cases, all of the units can be used during the peak season; only as many of the units as is necessary need be used during the remainder of the cooling season.

Where the air conditioning equipment must be installed outside of the conditioned area and where connection of the equipment to outside air is not possible or desired, air-cooled room type conditioners are ruled out. One or more self-contained conditioners must then be used.

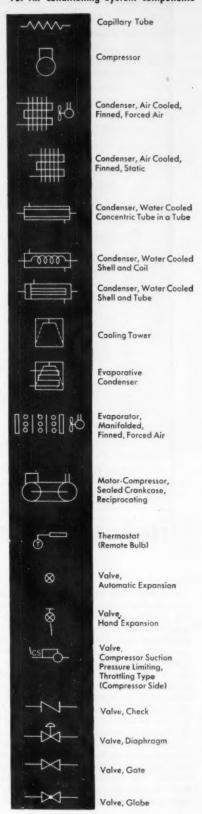
Where available utilization voltage is 110-125, single-phase, only room type conditioners can be used. Of course, if the interior is rewired for 230 volts, single-phase (or 208 volts, 3-phase; 220 volts, 3-phase; 440 volts, 3-phase), self-contained conditioners can then be used.

Where self-contained conditioners must be used, a choice must be made between the air-cooled and water-cooled type. Air-cooled self-contained units are available in the 2- and 3-ton sizes; larger units require connection

to an external source of water supply. For a particular job, the required capacity of refrigeration may be low enough to allow use of a single aircooled unit. If not, the operating economies of water-cooled conditioners must be weighed against the cost and possible difficulties of obtaining water supply and drain connections. Investigation of the water supply problem will indicate whether the air- or water-cooled conditioner is the better choice.

Electrical and mechanical characteristics of an area to be air conditioned must be carefully considered in relation to the application of air conditioning. Without a firm foundation of adequate wiring capacity, air conditioning cannot be safely and effectively applied. Branch circuit and feeder capacities should be carefully appraised in relation to the current requirements of the air conditioning equipment. Inadequate wiring systems should be modernized to properly handle the load. On the mechanical side, weight of equipment must be taken into consideration in locating and mounting. Floors or other structural members which bear the weight of equipment must be sufficiently strong to provide safe support. Self-contained units can load a floor to as high as 200 pounds per square foot. Such loads often require additional support from below to prevent cracking of ceiling plaster on the level below. In locating unitary equipment, floor and beam loadings should be carefully determined.

GRAPHICAL SYMBOLS For Air Conditioning System Components



ITEM	Quantity	Factor	BTU Per Hour
1. PEOPLE: Number Sitting or Moving Slowly		400	
Number Working, Dancing, etc		660	
2. WINDOWS EXPOSED TO SUN (Include only exposure with largest window area)	sq ft		
3. LIGHTS AND ELECTRICAL APPLIANCES (Do not include those listed in Table B)	watts	3.4	
4. OTHER HEAT SOURCES			
5. WINDOWS NOT INCLUDED IN ITEM 2	sq ft		
6. WALLS AND PARTITIONS (Do not include window area)	sq ft		
	sq ft		
	sq ft		
7. FLOOR	sq ft		
8. CEILING	sq ft		
.9. VENTILATION OR INFILTRATION	cfm		
10. Total BTU Per Hour Cooling Load to be	E USED FOR SELEC	TION OF UNIT	

COOLING LOAD ESTIMATE FORM FOR SELF-CONTAINED AIR-CONDITIONERS

The following paragraphs indicate the method to be used in determining cooling loads using the accompanying Cooling Load Estimate, the numbers of the paragraphs referring to corresponding item numbers of the Estimate Form. Cooling Load factors to be inserted may be found in Tables A through E. Summer outside design temperatures must be known for the geographical area involved in order to use Tables C and E. For reasons of space limitations, these temperatures cannot be reproduced here but may be obtained for the principal cities of the United States by referring to the Heating, Ventilating, Air Conditioning Guide published by The American Society of Heating and Ventilating Engineers.

1. Insert under Quantity the number of persons to

1. Insert under Quantity the number of persons to normally occupy the space after the air conditioning is installed. If all the people are engaged in the same activity, the number should be placed on the proper line. If some are more actively engaged than others, the total number would be properly divided on the two lines.

If it is a space which would be occupied by a large number of people for only a few minutes' duration and then a smaller number for the remaining time, use the largest number which would be present for approximately 15 minutes' duration.

Note: For all items, the Quantity (in this case, number of people) multiplied by the proper Factor gives the load for that item in Btu per hour.

2. Insert the maximum total square feet of window area on any one wall of the space exposed to direct sunshine. Refer to Table A and select the proper factor which must be inserted in the space indicated. If all the windows are on the north wall or on a wall shaded completely from the sun by an adjacent building, no figure will appear in this item.

3. Insert the total number of watts in use, not including the watts consumed by appliances listed in Table B. Lights in store showcases, for example, contribute heavily to the load and must not be neglected.

COOLING LOAD FACTOR

TABLE A: V	WINDOW	S EXPOSE	D TO SUN				
Direction Windows Face	NE	E	SE	S	sw	W	NW
Clear Glass (Single or Double) No Protection	110 30	180 50	160 45	105 30	160 45	180 50	110 80
Light-Colored Inside Shades or Venetian Blinds	65	110 72	95 64	60 42	95 64	110 72	60

Beauty Parlors	Number of Operators	× 2000	-	************************
Electric Motors	Total Nameplate HP	× 2800	=	***************************************
†Gas Burners	Number	× 6000	=	*************************
†Glass Coffee Makers	Number	× 900	=	********************
†Coffee Urns-Gas or Electric	Coffee Capacity in Gallons	× 1400	=	*************************
†Steam Tables-Electric	Sq Ft Area of Top	× 550	=	***************************************
†Steam Tables—Gas	Sq Ft Area of Top	× 1300	=	***************************
Additional Heat Sources	***************************************	Btu/Hr	=	
† Factors for appliances equipped with hood an	d positive exhaust should be reduced by 50%.	Total	=	***************************************

Outside Dry Bulb, °F	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	10
Windows (No Sun) Walis—Heavy Masonry Walis—Average Masonry Walis—Insulated Masonry or Frame. Walis—Average Frame Partition—Inside, Double Thickness. Partition—Inside, Double Thickness. Partition—Display Window Back. Glass Brick (No Sun Exposure) Floor. Ceiling under Univentilated Attic* Ceiling under Ventilated Attic* Ceiling under Flat Roof* Ceiling under Floor*	2 5 8 11 4 2 11 7 13	9332353249117133	10 3 3 2 3 6 3 13 5 2 11 8 14	11 8 8 2 8 7 4 18 6 2 2 8 14 8	12 4 4 4 7 4 14 5 8 12 9 14 8	18 4 4 2 4 8 4 14 6 8 12 9 15 8	14 4 4 8 4 8 4 15 6 8 12 10 15 4	15 4 4 8 4 8 5 15 7 8 13 10 15 4	16 4 5 8 5 9 5 16 7 8 13 10 16 4	17 5 5 5 10 5 17 8 4 13 11 16 5	18 5 5 8 5 10 6 17 8 4 13 11 16 5	19 6 8 5 11 6 17 8 4 14 12 17 5	20 5 6 4 6 11 6 18 9 4 14 12 17 5	21 6 6 4 6 12 6 19 9 4 14 13 17 6	22 6 6 4 6 12 7 19 10 5 13 13 18	23 6 7 4 6 13 7 19 10 5 14 18 6	24 6 7 4 7 14 7 20 10 5 15 14 18 6	25 6 7 4 7 14 8 21 11 5 15 14 19 7	

=Room Height,(L) = Length,(W) = Width,(G) = Wall Factor
om with one outside wall, (G) = 1
o outside walls, (G) = 1.5
ree or more outside walls, (G) = 2
$\mathbf{M} = \frac{(\mathbf{H})\times(\mathbf{L})\times(\mathbf{W})\times(\mathbf{G})\times($
1

		TAB	LE E	VEN	TILAT	TION (R IN	FILTR	OITA	N FAC	TOR						
Outside Wet Bulb, F	64	65	66	67	68	69	70	71	72	73 23	74	75	76	77	78	79	80

4. Use Table B for calculating the heat load due to gas and electrical appliances and motor-driven apparatus. Insert the total in the space indicated in Item 4.

5. Insert the total square feet of windows not included in Item 2. In Table C select the factor for these windows under the design outside dry-bulb temperature previously established for the geographical area involved. Insert this factor in space indicated in Item 5.

6. Three lines are provided in this item, as it is quite possible that several wall constructions may be used on a particular space. In each case subtract the area of the windows from the total net wall or partition area. In Table C select the proper wall or partition factors shown under the design temperature already established. Insert these factors on the proper lines in the spaces indicated in Item 6.

7. Insert the total square feet of floor area. Refer to Table C for the factor to be inserted.

8. Insert the total square feet of ceiling area. Refer

to Table C for the factor which fits the conditions of the building. Adjust this factor if ceiling is insulated in accordance with instructions below Table C.

9. Use Table D for calculating the ventilation or infiltration cfm. The total number of occupants must equal the number used in Item 1. The infiltration does not include the cfm which will enter the space if doors or windows are permitted to remain open. Insert the resulting cfm in the space provided in Item 9. Refer to Table E and select the factor shown under the design outside wet-bulb temperature previously established for the geographical area involved.

10. Add up the cooling loads, for Items 1 through 9. This is the total number of Btu per hour which must be removed. An air conditioner with capacity equal to or greater than this load must be selected to obtain comfort conditions within the space.

Source: Air-Conditioning and Refrigeration Institute

ITEM	Quantity	Fa	ctor	BTU Per Hour
1. WINDOWS EXPOSED TO SUN, FACING*		Inside Shades	Outside Awnings	
a. East, Southeast, or South	sq ft	45	25	
b. Southwest	sq īt	65	40	
c. West	sq ft	100	60	
d. Northwest	sq ft	35	25	
2. WINDOWS FACING NORTH OR IN SHADE (Include all windows not included in Item 1.).	sq ft		14	
3. Walls (based on lineal feet of wall) a. Light construction, exposed to sun*.	ft		90	
b. Heavy construction, exposed to sun* .	ft		50	
c. Shaded walls or partitions (Include all walls not included in 3a or 3b.) *Use for only that exposure used in Item 1.	ft		30	
4. Roof or Ceiling (Use one only.)				
a. Roof, uninsulated	sq ft		16	
b. Roof, with one inch or more insulation .	sq ft		7	
c. Ceiling, with occupied space above	sq ft		3	***************************************
d. Ceiling, with attic space above	sq ft		10	
5. FLOOR (Neglect floor directly on ground or over unheated basement.)	sq ft		3	
6. PEOPLE AND VENTILATION—Number of people	***********	ç	000	***************************************
7. LIGHTS AND ELECTRICAL EQUIPMENT IN USE	watts		3	
8. Doors and Arches Continuously Open To Unconditioned Space (lineal feet of width)	ft	8	300	
9. TOTAL LOAD in cooling units to be used for selection of room air conditioner (s)	xxxx	x	xxx	

COOLING LOAD ESTIMATE FORM FOR ROOM AIR CONDITIONERS

This Cooling Load Estimate is suitable for comfort air conditioning jobs not requiring specific conditions of temperature or humidity. This form may be used for all cities in the United States except the few where the outside design temperatures are appreciably above 95F dry bulb and 78F wet bulb. In these cases the load estimate should be modified by a method such as that used in the preceding Cooling Load Estimate Form for Self-Contained Air Conditioners.

The following paragraphs indicate the method to be used in determining cooling loads, the numbers of the paragraph referring to item numbers of the Estimate

1. Under Quantity, insert the total square feet of window area for the unshaded exposure having the largest cooling load. For windows shaded by inside shades or venetian blinds use the factor for Inside Shades. For windows shaded by outside awnings or by both outside awnings and inside shades (or blinds), use the factor for Outside Awnings. Only one number should be entered in the right-hand column for Item 1.

Note: For all items, the Quantity (in this case, the area in sq ft), multiplied by the proper Factor, gives the load for that item in Btu per hr.

2. Insert the total square feet of window area of all windows not included in Item 1.

3. On line 3a or 3 b, insert the length of the wall that had the largest sun load in Item 1. The total length of all walls and partitions not included in Line 3a or 3b should be inserted on line 3c. (The factors are based on a wall 9 ft high and are applicable to walls of usual heights and average construction. An uninsulated frame wall or a masonry wall 8 inches or less in thickness is considered Light Construction, 12 inches or over Heavy.)

4. Insert the total square feet of roof or ceiling area on Line 4a, 4b, 4c, or 4d. (Use one only.)

5. Insert the total square feet of floor area. Neglect this item if floor is over ground or unheated basement.

6. Insert the number of people who normally occupy the space to be air conditioned. The factor includes the normal cooling load per person and approximately 15 cfm of ventilation air per person.

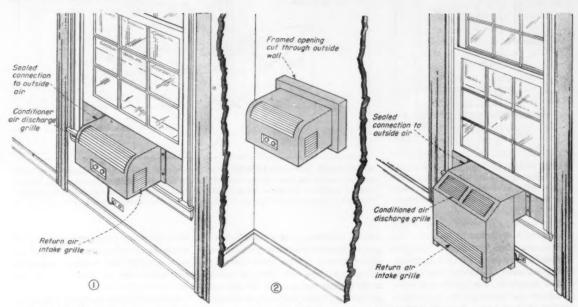
cfm of ventilation air per person.
7. Insert the total number of watts for lights and electrical equipment that will be in use when the room air conditioner is turned on and when the sun is shining.

8. Insert the width of any door or arch that is continuously open to an unconditioned space.

9. Add the loads of Items 1 through 8. This is the total load in Btu per hour. A room air conditioner or conditioners with capacity equal to or greater than this load should be selected.

Source: Air-Conditioning and Refrigeration Institute

INSTALLATION



WINDOW-TYPE room conditioners may be installed in either of two ways: (1) through the window on a built-up, sealed supporting assembly; or (2) through an outside wall in which a proper sized, framed and sealed opening has been made.

CONSOLE MODEL with air-cooled condenser is usually located up against a window with a short duct section from the back of the unit protruding through a sealed framing assembly.

BY THE time any air-conditioning job reaches the installation stage, the equipment has already been selected and mounting location(s) determined. By this time, it has also been established that the interior has or will be equipped with such electrical and mechanical facilities as are necessary for operation of the selected equipment. The only things which remain to be done are the mounting and supporting of the equipment and the completion of external connections.

Proper installation of unit-type air conditioners is absolutely essential to economy and efficiency of the cooling operation. On any job, therefore, electrical and mechanical details of installation must be executed carefully and in strict accordance with manufacturers' instructions. Although the extent of installation work varies with types and sizes of conditioners, the methods and techniques used in installing each particular type are more or less standard. The following section sets forth installation details for the various types of conditioners and covers electrical and mechanical installation factors involved.

Room Conditioners

Of all unit type conditioners, room conditioners represent the minimum of installation detail. This detail, however, will vary with the exact type of room unit being installed. For the purpose of analyzing installation details, then, room conditioners can be divided into the following types:

- 1. Window units,
- 2. Console models, air-cooled and
- 3. Console models, water-cooled.

Window Units: Installation of a window-type room conditioner involves mounting of the assembly in the window frame and connection of the unit to the source of electric power. Of course, the width and construction of the window should be such as to accommodate the dimensions of the unit. Mounting should be made in accordance with instructions of the manufacturer.

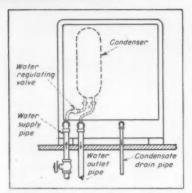
First, mounting angles, brackets, seals and braces are secured to the window frame, per instructions. Then an outside casing is mounted to the window frame assembly, and sealing of the window frame is made secure. Finally, the chassis of the unit is placed in the casing assembly. There are any number of variations on the specifics of the installation procedure; however, the important thing in all cases is to remove any bolts or lugs used to support the unit during shipment. When the conditioner is installed in a doublehung window, the window cannot be closed down and locked in the con-

ventional manner; a new lock should be installed.

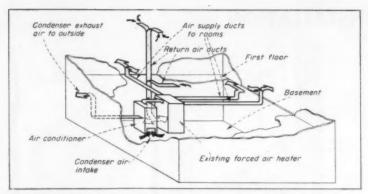
Installation of air conditioners in casement-type windows usually requires special methods in each case. Generally, enough of the glass and mullions must be removed to accept the cross-section of the unit. Usually the window sill on the room side must be built up until its top is above the horizontal cross member forming the bottom of the metal window frame. The unit should not be allowed to rest on the window frame: vibration of the unit will be transmitted to the window frame and objectionable noise will develop. Again, however, full details on installation of particular units in casement and French windows are given in manufacturers' literature.

For best performance, window-type conditioners should be installed in windows which are well shaded from the direct rays of the sun. If naturally shaded windows are not available, awnings can be used. When the unit is finally installed in the room, care should be taken that furniture near the unit does not block or interfere with free flow of air into and out of the unit.

Window units may also be mounted through suitable wall openings in those interiors which have no windows available or in which the windows are not



WATER PIPING for typical console model room conditioner with water-cooled condenser indicates three pipe lines which must be run for water-cooled conditioners.



AIR-COOLED SELF-CONTAINED conditioners are commonly combined with residential forced air heating systems; distribute conditioned air in the heating ducts; require addition of only a short length of duct for condenser heat exhaust, either through a basement window or through the wall, as shown at left.

conveniently or properly located. In such cases, the conditioner can be mounted at any desired height from the floor. As soon as the opening in the wall is completed, the installation procedure is the same as for a regular window installation. Special installation instructions on providing the proper opening in frame and brick construction are usually supplied by the manufacturer. These instructions cover cutting and framing of the opening, mounting of the unit in the opening, sealing the installation and providing any necessary control extensions.

Air-Cooled Console Models: Installation of a unit of this type is similar in detail to installation of the window type. The unit must be placed up against a window or opening in a wall; a well-sealed connection is made between the unit and outside air; and connection is then made to the electric supply. These units are often designed to accommodate ductwork for distribution of conditioned air. In many cases, a unit of this type, without the decorative cabinet enclosure, can be located remote from the area to be air conditioned, and the air distributed in ducts. Available in 1- and 14-hp sizes, these units are generally rated for 230-volt, 1-phase circuits or 208-volt, 3-phase circuits. Manufacturer's literature for particular units provides installation

Water-Cooled Console Models: These units differ from the air-cooled models in that their condensers are cooled by water and do not require connection to outside air. For this reason, water-cooled console models may be located anywhere in or out of the area to be air conditioned, using duct distribution when located out of the area. Installation of one of these units consists of positioning the unit,

making necessary pipe connections and connecting to the electric circuit. Usually available in the same sizes and voltage ratings as the air-cooled models, these units are more efficient, producing greater cooling effect for the same electrical input.

Details on the installation of the water supply line and provision of suitable drains for the condensate line and the condenser water outlet can be obtained from the manufacturer of the particular unit. Information on ductwork for distribution of conditioned air can also be obtained from the manufacturer.

The final step in the installation of any room conditioner is the connection of the unit to the electric supply. Of course, the supply voltage and current carrying capacity of the circuit conductors must conform to the requirements of the National Electrical Code and local codes for handling the power load described on the unit's nameplate. To assure steady growth in the application of room conditioners, the importance of strict compliance with electrical safety code provisions cannot be overstressed. And without a strong electrical backbone, air conditioning equipment will not perform efficiently and economically. For these reasons, the electrical part of an air conditioning installation is far from just a matter of plugging it in," as implication often has it. From the type of receptacle and the size of branch conductors and feeders to the type and size of service, an electrical system must be appraised as to its ability to handle an air conditioning load. Installation of even a small amount of air conditioning, in many cases, requires rewiring. In other cases, so much additional capacity is needed for air conditioning that major revamping and modernization of the whole electrical system to handle an even greater load becomes economically sound and is made part of the job.

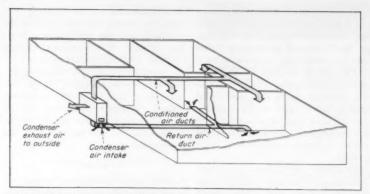
Provisions of National Electrical Code Articles 210 and 430 apply to room conditioner installations as indicated therein. (See Secs. 2115 a., 2116, 2121, 2123, 2125 a., 2126 a. and b., 4304 b., 4309 b., 4312, 4314, 4315, etc.) Although local codes may amplify or modify these provisions of the NEC, it should be remembered that safety code provisions are invariably minimum requirements, concerned chiefly with safety and not with adequacy, convenience or performance.

Some general considerations on the electrical details of room conditioner installations are as follows:

- No-load and full-load voltage to a unit should always be checked prior to installation. Many sections of the country are suffering from over-loaded power lines and, as a result, low voltage.
- Low voltage causes overheating of motor and may result in serious damage.
- Voltage drop at full-load should not exceed 10% of nameplate voltage of the unit.
- Voltage at the unit must meet minimum requirements when all other equipment on same circuit is operating.
- Units of $\frac{3}{4}$ hp and larger sizes are best applied on 208- or 230-volt circuits.
- Circuit protection and equipment grounding should conform to NEC.

Self-Contained Conditioners

Although most self-contained air conditioning units are equipped with water-cooled condensers, some self-contained units in the 2- and 3-hp sizes



RESIDENTIAL INSTALLATION often consists of air-cooled self-contained unit, located in basement, garage, attic or other place where ready connection can be made to outside air, with supply and return ducts laid out as shown. Water-cooled unit may be used, requiring no connection to outside air.

are air-cooled. Following are separate discussions of the installation methods and techniques for each type:

Air Cooled: These units are designed primarily for use in combination with residential forced-air heating systems. A unit of this type may be installed in the basement alongside the hot-air furnace, with connection to the common duct system for distribution of the conditioned air. In such an installation, condenser cooling air is taken from the basement and rejected to the outside by duct connection to a window or other opening. possible arrangement involves the 2section model of air-cooled conditioner. In this case, one section of the conditioner, consisting of the evaporator and condensate drip pan assembly, is installed in the furnace air-outlet duct; the second section, the condensing assembly, may be installed in the attic, utility room, basement or outside the house. With this setup, the furnace blower forces air across the evaporator, cooling it, and directs the air into the distribution ducts. The room heat transferred to the evaporator is passed along to the condenser, from which it is discharged to the outside. Although these two samples describe installation for use with the heating ducts, aircooled self-contained conditioners may also be used in residences or commercial interiors with their own system of ducts for distribution.

Installation of the air-cooled model in conjunction with the basement hotair furnace involves little more than mounting of the assembly, arranging the duct tie-in to the heating duct and providing the required electric supply and control circuits. Installation of the 2-section model involves somewhat more detail. First, refrigerant piping between the evaporator and the con-

denser unit must be provided. Locating, mounting and connecting the condenser assembly involves piping, sometimes ducting and electrical wiring. As far as possible, piping and ducts should be kept to a minimum. Manufacturer's instructions on type and size of piping and type of connections to be made should be followed carefully.

Water-Cooled: Self-contained con-

ditioners with water-cooled condensers are available in 2-, 3-, 5-, 74-, 10-hp and larger sizes. Many of the units of this type are designed to be used in conjunction with forced air furnaces; many are for use with either free delivery of conditioned air from the unit to the area or with duct distribution of air. Although installation of the ductwork will vary with different applications, piping and electrical work follow fairly standard installation procedures. For clarity, separate analyses of mechanical details are as follows: Ductwork—For those cases in which the conditioner is to be used in conjunction with forced-air heating systems, connection of the conditioner into the heating duct system should be made in accordance with manufacturer's instructions. Some type of damper arrangement is usually installed in the duct system near the units to close the furnace discharge opening when the conditioner is operating and to close the conditioner discharge when the furnace is on. Generally, ductwork for this type of installation is a minimum. For those models which are not used with furnaces, a separate duct system must be installed for distribution of conditioned air when free delivery of air from the unit is not satisfactory. In some cases, only a minimum of duct is installed to provide outside air supply to the conditioner.

• Piping—Installation and connections

of water piping are essential to all applications of water-cooled self-contained conditioners. This will involve connection of the unit to a source of water-either city water, well water or a cooling tower. Of course, all piping should be made in accordance with applicable codes and ordinances. Water supply and return piping should be carefully sized for connection to the unit; pipes should be at least equal in size to the tappings on the unit. Pressure and temperature of the water should be taken into consideration in selecting pipe size. A water regulating valve should be installed in the supply line if city or well water is used, and water piping should be flushed thoroughly before being connected to the unit. In addition to supply and drain piping for the condenser cooling water, piping must be installed to provide drain for evaporator condensate from the drip pan. Disposal of discharge water and condensate drain can be made into a trapped funnel or sink discharge, with access for cleanout. When a cooling tower is used as the source of condenser water, piping between the tower and unit should be kept as short as possible, and pipe as large in diameter as possible should be used to minimize pressure losses. The size of pump required to circulate the cooling tower water will be determined by the total gallons of water needed by the unit and by the pressure losses of the complete circulating sys-Manufacturer's instructions should be carefully followed on the details of all piping work.

Electrical installation of any watercooled self-contained conditioner depends upon availability of power supply of characteristics which correspond to nameplate rating of the unit. Of course, rewiring may be necessary in many cases to provide a circuit of proper voltage and carrying capacity. This may involve increase in service voltage, installation of new feeders, running a new or larger branch circuit and installation of new distribution and control equipment. At least the minimum requirements of the NEC should be carefully observed in sizing and protecting conductors and equipment. Voltage drops should be within required limits to assure maximum operating efficiency of the conditioners. Control wiring for thermostats and other devices should be made in accordance with manufacturer's wiring diagrams.

Accompanying illustrations present only basic layouts for conditioning equipment; infinite variations are possible for particular cases.

MAINTENANCE

WHEN the installation of the conditioning equipment has been completed, tests should be made to make sure the unit is accomplishing the degree of cooling at the consumption of power claimed by the specifications. Also, since installations usually carry an obligation of guaranteed performance for a specified period of time, the same tests apply should future complaints of faulty operation be made to the installer.

Testing of Units

Test tables given by manufacturers for all models of their air conditioners are compiled by operating production models under various conditions of temperature and humidity. A portion of a typical performance chart is presented here with examples of satisfactory and unsatisfactory performance. Most charts of this type include data covering outside dry bulb temperatures from 70F to 110F at various wet bulb temperatures at the evaporator room inlet. For each of these wet bulb temperatures, there are specified wattage limitations within which the total power drawn by the unit should fall. Also shown, for each wet bulb temperature is the approximate cooling to be expected, given as the dry bulb temperature difference between the evaporator inlet and outlet.

Four temperature readings are required, to be taken as nearly simultaneously as possible at the locations shown in the sketch. Thermometers should be securely mounted at least 6 inches from the unit, and temperatures must be allowed about five minutes to stabilize before reading. Outside thermometer must be shielded from the sun; wick of wet bulb thermometer must be wet. Power reading is taken with a standard wattmeter at the unit's electrical input. Method of interpreting readings is shown by the two examples given.

Similar charts and procedures are followed in the testing of water-cooled units, the principal exception being that cooling water outlet temperatures are required in place of condenser air inlet temperatures.

Sources of Trouble

Where a condition of improper cooling is encountered, yet all component parts appear to be functioning, there are certain preliminary checks which should be made:

(1) Make sure the unit is receiving its proper supply voltage.

(2) Determine whether capacity of unit is sufficient for space being cooled. Experience in computing cooling loads will soon make it possible to detect cases of insufficient capacity after a brief survey of the space being cooled.

(3) Make sure there are no unnecessary openings from the conditioned space to other parts of the building, such as doorways or transoms. If such openings are needed and can't be avoided, a larger conditioner may be in order.

(4) Check installation of unit. There should be no leakage of air from inside to out or vice versa around window-type conditioners or around the ductwork of self-contained and console types.

(5) Make sure there are no obstructions to the air intake and exhaust, both indoors and out, such as window drapes, or furniture or material stored against louvers, and that outside exhaust air is not somehow being deflected back into intake.

(6) Check thermostat, if one is used, for proper setting. If all the above is in order, some internal obstruction to air flow or some defect in the refrigeration system is to be suspected.

Internal Obstruction to Air Flow: The formation of ice or frost on the coils of the evaporator is an indication that a sub-normal supply of air is flowing through the evaporator. With insufficient heat available for the evaporation process, the temperature of the evaporator may drop below the freezing point of water.

Insufficient condenser air may cause abnormally high pressures to be built up in condenser, since the heat isn't being carried away. Water-cooled units have high-pressure cutout switches to stop the compressor, but air-cooled units continue to operate. Extreme reduction of air could result in serious damage to the compressor.

A frequent cause of restricted air flow is the accumulation of dirt in the filter or between the coils of the evaporator or condenser. They should be cleaned thoroughly; filter should be replaced if necessary. Improper operation of the condenser or evaporator fan is another factor to be checked. Direct-connected fans may be out of alignment or slipping on shaft; belt-driven fans may have loose or worn belts or pulleys; fan motor may be in need of oiling or greasing.

Defect in Refrigeration System: Internal work on components of the refrigeration system should be done only by a competent refrigeration mechanic. Smaller units require the replacement of the complete system

should internal defects develop; hermetically sealed compressors must be replaced in case of trouble. Internal causes of insufficient cooling include low refrigerant charge due to leaks in the system, defective expansion valve, clogged liquid line strainer (often built into expansion valve), improper functioning of the discharge and suction valves of the compressor, or too much oil in the compressor.

Naise

Another complaint which could arise soon after installation is that of noisy operation. All conditioners have a normal sound level; some are noisier than others. In addition to the cost of operation and installation, the noise level should be a chief factor of consideration in the purchasing of the unit, depending upon the use of the space to be conditioned. The owner must expect a certain amount of noise.

However, a decided increase above the normal sound level may often be traced to improper installation or abnormal internal operation which may be readily corrected.

Improper Installation: A check of the overall setup while the unit is in operation may disclose one or more of the following sources of noise:

 Hold-down bolts or shipping blocks may have been left in place; they should be removed.

(2) Unit may not be level or properly supported.

(3) Rubber vibration mounts may be worn and should be replaced.

(4) Outdoor air intake or exhaust ducts may be insecurely fastened.

(5) Screen on outside duct or damper opening may be loose and vibrating.

(6) In the case of window conditioners, a poorly constructed window may rattle, even though the conditioner is operating normally.

Internal Noise: If a conditioner has been inoperative for a considerable period of time, the refrigerant may have become absorbed in the compressor oil within the sealed system. The unit may be noisy for the first few hours of operation until the necessary working pressures have been established. If such compressor noise does not clear up within a reasonable time, internal compressor defects are indicated, which may necessitate the replacement of the sealed system. Following are other possible sources of internal noise which should be checked:

 Evaporator or condensing tubing bent or out of place and making contact with frame. (2) Loose electrical components (capacitor, relay, etc.).

(3) Compressor assembly unbalanced or supporting springs weak.

(4) Fan motor bearings defective or in need of lubrication.

(5) Improperly adjusted fan belt tension.

(6) Broken, bent, loose or misaligned fan blades.

(7) Fan motor mounting screws or nuts loose.

Preventive Maintenance

Proper instruction of the owner in the use and care of the conditioning equipment will result in greater satisfaction on his part and eliminate unnecessary trouble calls. As its name implies, preventive maintenance adds life to equipment through a program of inspection, cleaning and lubrication.

Inspection: Only the owner can be constantly alert to detect signs of possible trouble. Through daily manipulation of controls and observance of the effects, the process becomes more or less automatic. However, there is a certain amount of checking that requires special effort. All parts of the unit should be checked periodically for rust, since all normal operation takes place in a moisture-laden atmosphere. If electrical connections to the unit are not concealed or protected in conduit or raceway, the cord should be checked for fraving, cracking or other damage. Frequent blowing of the fuse in the conditioner circuit may mean trouble in one of the electrical components or may indicate an overload.

Cleaning: The complete conditioner must be cleaned at least once a year, preferably immediately after the cooling season, or as many more times as appears necessary. All cover plates should be removed and chassis of window units withdrawn from the window. All lint, dust, dirt and grime should be removed with a vacuum cleaner and cloth. Excessive or encrusted dirt around evaporator and condenser coils should be pried loose with a wire or stiff brush and removed. All rust spots should be cleaned and covered with proper protective paint.

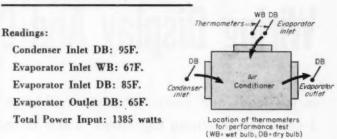
The air filter should be replaced or cleaned thoroughly at least every six months. It may need cleaning every two or three weeks in localities having an excessive amount of dirt in the air.

Lubrication: Some fan motors are permanently lubricated; others are equipped with oil and grease cups which require lubrication every six months to one year, depending upon usage. Compressor motors are usually self-lubricating.

PERFORMANCE CHART

Temperature,	Degrees F.	Total Power Input	Temperature Difference Degrees F.
Condenser Inlet (Dry Bulb)	Evaporator Inlet (Wet Bulb)	Watts	Evap. Inlet & Outlet (Dry Bulb)
100	79	1530-1670	10-13
	75	1535-1690	13-16
	71	1550-1700	17-20
	67	1560-1720	20-22
	63	1565-1725	20-22
95	79	1265-1410	11-14
	75	1305-1435	14-17
	71	1350-1480	17-20
	67	1375-1520	20-22
	63	1385-1530	21-24
	59	1370-1510	22-25

EXAMPLE 1: Satisfactory Performance



Temperature difference indicated by thermometers between evaporator inlet and outlet = 85 - 65 = 20 degrees.

From chart, temperature difference should be between 20 and 22 degrees, which checks with test data.

From chart, power input should be somewhere between 1375 and 1520 watts, which checks with test data.

EXAMPLE 2: Unsatisfactory Performance

Readings:

Condenser Inlet DB: 95F. Evaporator Outlet DB: 75F.

Evaporator Inlet WB: 67F. Total Power Input: 1530 watts

Evaporator Inlet DB: 85F.

Temperature difference indicated by thermometers between evaporator inlet and outlet = 85 - 75 = 10 degrees.

From chart, temperature difference should be between 20 and 22 degrees, which does not check with test data.

From chart, power input should be somewhere between 1375 and 1520 watts, which does not check with test data.



CONTRACTORS' WIRING EXHIBIT attracts attention at Chicago Electric Association's Better Wiring Exposition. Threeweek run brought in better than a dozen good job leads per day.



VISITORS LEARN the components of an adequate electrical service, distribution panel and individual circuits as contractor Wm. Veldhouse (Service Electric Co.) points them out.

Contractors'

Wiring Display And Clinic Pay Off

in job leads and public interest at Chicago Electric Association's 3-week Better Wiring Exposition. Booth to remain as permanent exhibit in Edison Company building.

WHEN members of the Cook County Electrical Contractors Association designed, built and manned an adequate wiring display booth as their contribution to the Chicago Electric Association's Better Wiring Exposition, they had no idea it would attract so much attention. Nor did they anticipate the quantity and quality of job leads picked up during the three-week show at the Commonwealth Edison Company building.

Instead of stressing number of outlets, the contractors beamed their story and display at adequate service entrance and circuit capacity—the foundation of a good wiring system. The public could see what an actual 3-wire, 100-ampere service and 12-circuit distribution panel looked like, touch it, see a lamp light up in the fuseholder when a button was pressed at the end of a circuit run. They could learn the component parts of an electrical service, what constituted a circuit, why

numerous circuits were necessary. They could mentally compare what they saw with what they have in their own homes.

Many visitors did just that after seeing demonstrations of low-voltage effects on appliance operation. They stopped at the wiring booth, asked questions of the three contractors on duty each day. Many sat down and discussed their electrical problems, clinic-fashion, with the contractor and got their answers on the spot or left with a definite appointment for a future call. Good leads of this type, where visitors asked for definite appointments, ran from 12 to 15 daily.

Contractors on duty had the privilege of pocketing all leads received from prospects in their neighborhood. Other leads were distributed by the association to members operating in the vicinity of the prospective customers' residence. One contractor received at least five good leads during one tour of duty at the show, turned all of them into jobs. One was a sale of an entrance service plus an electric range and refrigerator. Another was a new service which was installed before the show closed.

A typical day at the exhibit is illustrated in the acompanying sequence of unposed photos taken within a 30-minute period. Public interest of this type experienced at the show led to a decision to retain the residential wiring booth as an educational exhibit at the Electric Association's wiring display in the Edison building.

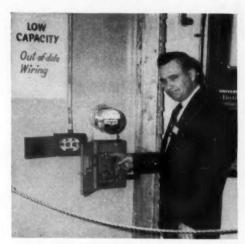
The spontaneous response of those homeowners who took advantage of this show to consult with an electrical contractor points up the all too-critical situation in which many find themselves saddled with inadequate electrical facilities. That the public is becoming wiring conscious is encouraging. That is the goal to which exhibits of this type are pointed.



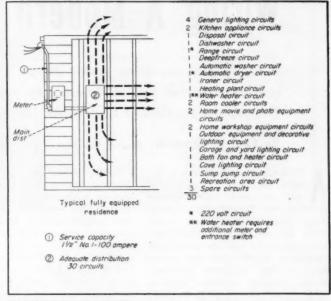
THOSE WITH SERIOUS electrical troubles stayed to discuss them with contractor on duty and leave a definite "appointment" slip for a future call.



OTHERS HAD THEIR questions answered on the spot. Here, contractor L. Matson (Active Electric Co.) explains solution with a circuit diagram.



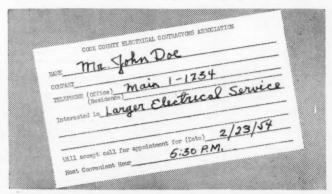
IF YOUR SERVICE looks like this, you're headed for serious trouble and should replace it with . . .



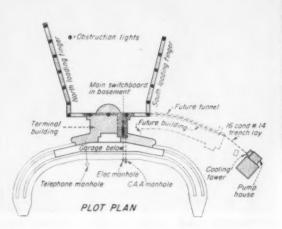
DISTRIBUTION CHECK LIST and service diagram was given each visitor. Suggestion was that homeowner check his system with that shown.



... A NEW 3-WIRE MODERN service of 100ampere capacity with plenty of branch circuits, contractor Matson tells show visitors.



APPOINTMENT SLIPS or job "leads" like this were turned over to neighborhood member contractors for immediate follow-up. Many jobs were sold before show closed.





AIRPORT LOBBY with recessed ceiling downlights and fluorescent lighted coffer dome.

Wiring A Modern Airport

A roundup of details on wiring design, equipment layout and installation methods—all part of the electrical system installed by State Electric Company at the Greater Fort Worth International Airport.

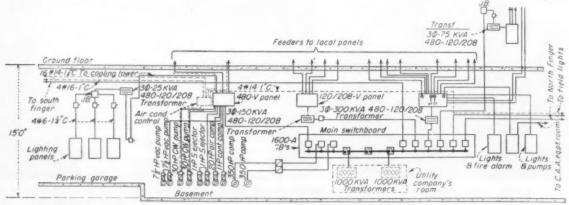
By Fred R. Schmidt, President, State Electric Co., Ft. Worth, Texas

CLEAR example of modern airport electrical construction is well represented in the Greater Fort Worth International Airport, Amon Carter Field, Ft. Worth, Texas. Here, we installed an electrical system of diversified light and power loads throughout 242,000 square feet of floor space in the completely air-conditioned, fireproof Terminal building. And to meet future growth of the building, the electrical system can readily be expanded to twice its capacity.

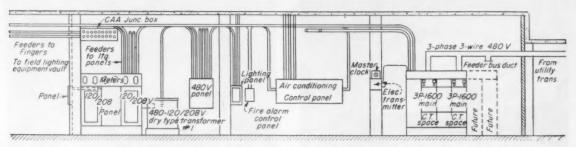
Electric power for the airport is delivered from a manhole under the roadway at the front of the Terminal building. Six 4-inch concrete-encased fiber conduits make a direct run to a transformer room in the basement of the building. There, two 1000 kva transformers of the utility company feed 480-volt, 3-phase, 4-wire power in non-ventilated feeder bus duct to the main switchboard.

The feed from each of the two transformers is through a 3-pole 1600 amp breaker, to the main switchboard bus, divided between the pair of incoming feeders. As shown in the riser diagram, distribution from the main switchboard is radial. Power at 480 volts is supplied to four 480-120/208-volt transformers; to motors for compressors, pumps and air conditioning units; to field lights; and to transformers in the North and South loading fingers of the building.

In the Terminal building, risers from a 480-volt power panel, fed di-



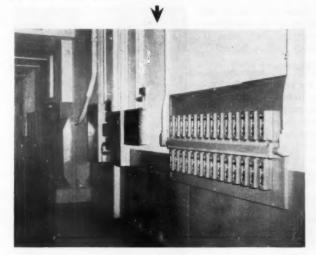
DISTRIBUTION DIAGRAM showing hookup of equipment in basement and feeders up to light and power panels.

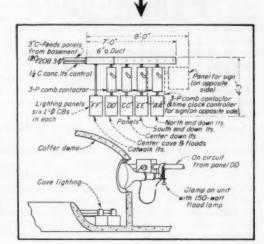


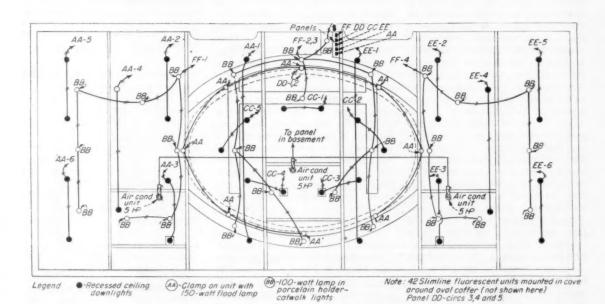


EQUIPMENT LAYOUT along south wall of basement—main switchboard and, shown in picture below, air conditioning pushbutton board and distribution panels.

MOUNTING DETAILS of equipment in attic—arrangement of lighting panels (top), and mounting of one of the flood lamps used to light the coffer dome (bottom).







ATTIC PLAN above main lobby shows circuiting and layout of lighting equipment,



TICKET COUNTERS are lighted by a continuous row of diffusing-glass shielded 2-lamp, 4-foot fluorescent troffers above counter, cove lighting along the outside edge.



DINING ROOM uses recessed incandescent lens boxes to achieve comfortable level; has cluster of four R-lamps over piano on revolving turntable.

rectly from the main switchboard, supply 6 air conditioning units on the ground floor, 8 on the first floor, 4 on the second floor, 3 in the space above the concourse ceiling and 1 on the third floor—a connected load of 53 hp. Lighting on these floors is served by risers from two main 120/208-volt distribution panelboards in the basement.

C.A.A. electrical requirements are also supplied from one of the 120/208volt main distribution panels. This panel supplies light and receptacle circuits in the C.A.A. offices on the second floor, the equipment room on the third floor, the junction space on the fifth floor and the control room on the sixth floor. And from this panel metered energy is also fed to a C.A.A. load distribution panel in the basement, from which point energy is delivered to the radar room on the third floor and to the far reaches of the C.A.A.'s extensive lighting and control system. Additional electrical facilities in the Weather Bureau on the second floor, the third floor equipment room and the control room are served by another metered supply from a panel on the second floor.

The North and South loading fingers, the extending runs of the building, are electrically powered from 480-volt CB's at the main switchboard. For the North finger, three 500 MCM, RH cables in 3-inch conduit are run from the board in a straight line to the field end of the basement, then through a walk-in tunnel out to and under the length of the finger. Along this tunnel under the finger four 480-120/208-volt transformers are tied into the feeder. From the 480-volt panels feeding the transformers, power is tapped off for motor loads along the field level of the finger. Lighting and receptacle circuits on the field level and passenger concourse level of the finger are supplied by the transformers. Similar electrical distribution is made in the South loading finger.

Lighting

Throughout the interior of the Terminal building, lighting is functional and decorative, in keeping with the modern construction of the building. Both fluorescent and incandescent lighting are used to meet varied lighting requirements.

In the main lobby, an interior 140 ft. by 60 ft. by 31 ft. high, incandescent down lighting and fluorescent cove lighting provide general illumination. The downlights are recessed in the lobby ceiling and in the large oval shaped coffer in the center of the ceiling. The cove around the inside lip of the coffer utilizes 42 48-in. slimline fluorescent lamps, mounted with their ends overlapped to eliminate demarcation shadows on the coffer. Flood lamps, concealed behind the cove edge, are mounted on wide spacings around the cove to further light the coffer dome.

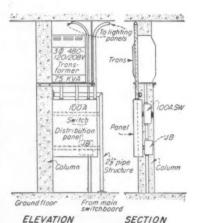
In the main dining room, off the lobby on the field side of the building, 34 recessed incandescent lens boxes are used to light the interior which is terraced in two levels. Four R-lamps are recessed in a cluster above a piano which is located on a revolving turntable in the center of the half-circle shaped room. Room lighting is controlled by dimmers which allow varying of required level.

Overall, this modern airport has received a full electrical treatment.

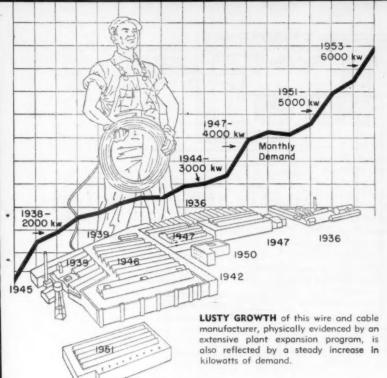
Associated architects on the airport were Joseph R. Pelich and Preston M. Geren; consulting engineers, Yandell, Cowan and Love Engr. Co.; general contractors, Thos. S. Byrne, Inc.—all of Ft. Worth, Texas.



control Panel for one of two 350-hp compressors in basement is fed directly at 480 volts from main switchboard. That's Fred Schmidt, State Electric, at the panel.



RACK ASSEMBLY supports transformer on ground floor of building. Switch, feeding transformer, and the secondary distribution panelboard are part of assembly.



At the Rome Cable Corporation, Practical Analysis was the . . .

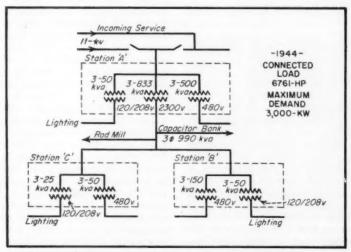
Key To Long Range Modernization

Rapid plant growth during a period of critical material shortages can, and did, result in an overloaded electrical system containing limitations of disintegration, obsolescence, inadequacy and hazards. Now, however with restrictions lifted, true modernization can be obtained by installing dual primary and secondary feeders, revamping substations, balancing electrical loads on circuits, installing modern switchgear, increasing illumination levels, installing plug-in duct and capacitors.

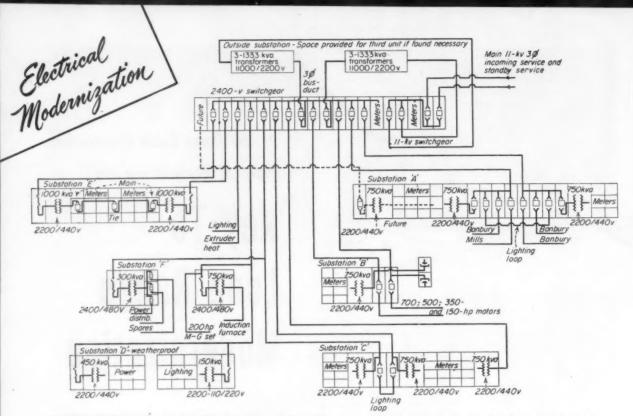
By Hugh P. Scott

OR the past dozen years many large plants—constructed prior to World War II—have been caught in a tight squeeze with the necessity for increasing their productivity on the one hand, and with limitations of inadequate electrical distribution systems on the other. This has been a serious problem for, judged by today's standards and demands, initially-installed equipment has become obsolete and even hazardous, yet it is being called upon to serve ever-increasing electrical loads.

This dilemma has prompted the adoption of many so-called "modernization" programs, in which transformers, switchgear, busduct and capacitors have been added to original systems in haphazard fashion. For the most part, these programs have



A DECADE AGO electrical distribution facilities were limited in scope and dangerously overloaded—a condition caused by the war-years' necessity of boosting production, while keeping "one step ahead of a breakdown".



PRESENT SYSTEM is result of realistically appraising formerly-existing limitations and weaknesses, also evaluating present and future electrical needs. New installation—with dual 11-kv pri-

mary service entrances, revamped and augmented substations, modern switchgear and liberally-sized secondary power feeders—has overcome formerly-present obsolescence.

kept plants running, production schedules have been met, and distribution systems have remained at least "one step ahead of a breakdown". But calling these stop-gap measures "modernization" programs is a tongue-in-cheek evasion, for this approach jeopardizes flexibility, safety and efficiency, and fails to anticipate any additional future growth.

Since exceptions to this general approach are few, it is encouraging to review the logical modernization program adopted by the Rome Cable Corporation of Rome, New York.

Like other war-growth companies, Rome Cable had become saddled with an overloaded electrical system but due to critical shortages of materials and equipment, they had been forced to follow a what-can-we-get policy rather than a what-do-we-need approach. The doubtful wisdom of this procedure was constantly evident and appreciated, however, so as soon as critical shortages lessened several years ago, Rome executives wisely decided to re-evaluate their needs and establish a realistic program of modernization and expansion based upon future load expectations.

To analyse their problems, they employed a competent consulting engineer —E. A. Pelton of Pottsdam, N. Y. who extensively surveyed the existing system, studied plant layout and growth curves, evaluated future power requirements, then came up with ten practical, long-range recommenda-

Why Modernize?

As a result of this survey, it was discovered that the existing electrical system had five definite limitations. These included (1) disintegration, the normal and understandable result of usage and time elements, (2) obsolescence, also an understandable condition emphasized by more recent equipment on the market having greater advantages and better design features, (3) inadequacy, due to the fact that load growth of the plant had wiped out all reserve transformer and distribution capacity, (4) hazards, to property and personnel alike, caused by overloaded circuits and breakers, and (5) circumvention, that is, instances where standard practices and recommended methods had been compromised or by-passed in order to service essential production machinery on short notice on already-overloaded circuits.

From these findings it was evident

that planned, realistic modernization was imperative, not only to meet existing requirements but to provide for the future. It was also recognized that a new distribution system would (1) result in better voltage and operating characteristics, contributing to more efficient production (2) remove the danger of fire, a positive insurance and security factor, (3) provide increased dependability for operating under severe conditions without fear of a breakdown, (4) establish flexibility, permitting rearrangement of equipment within the plant if found desirable, and (5) provide sufficient feeders in close proximity to each other so that connections could be shifted from one power distribution medium to another, permitting a partial interruption of power without disrupting plant production, and establishing selectivity.

The Practical Approach

In planning the new system, many pertinent questions received consideration, such as; what is the objective to be accomplished? What is the function of the equipment and other system components? What type of equipment should be specified? How much emphasis should be placed on first cost? What savings can we make?

Factors considered in connection with the selection of equipment included dependability, safety, maintenance facilities, interchangeability of equipment, simplicity of installation and operation. The question of possible savings prompted a discussion on rental charges to the local utility company for power transformers, present and future control of demand charges, future maintenance costs in both labor and materials, better voltage and operating characteristics, and continuity of operation in production.

Even these sub-headings were analysed, bringing into focus the logical deduction that first cost is a deceptive factor, for it can be weighed and properly evaluated only when overall savings are considered. For example, if a plant is shut down due to power interruption; all overhead charges, such as fuel and payroll, continue. Therefore the cost of a standby unit, duplicate feeders or switchgear having higher capacities should be related to the importance of the circuits involved. the number of employees working in an area, the value of the machinery being served, and many factors related to the product being manufactured.

When considering different types of equipment, another logical approach was to determine differential costs of units, rather than to contemplate only those charges related to the unit selected. For example, at Rome it was realized that installing oil circuit breakers in the primary of each 11-kv transformer would be relatively expensive. Yet, at the same time, it was acknowledged that if OCBs were not installed, some other type of disconnect would have to be used. Therefore the question of cost was influenced by these differential price tags, and it was found that, for an extra \$800, flexibility of dual control plus worthwhile insurance against operational disruptions could be obtained.

This same line of practical reasoning influences other selections as well, such as dual versus single feeders between the main substation and loadcenter subs.

Ten Basic Recommendations

With every decision supported by similar patterns of analysis and logical comparison, Consulting Engineer Pelton made the following ten recommendations:

(1) Abandon the then-existing practice of renting transformers from the utility company, and install companyowned equipment instead, thereby escaping the continuation of monthly rental charges.

(2) Obtain dual 11-kv primary service facilities, each one sufficiently large to carry the plant's entire load so that one feeder could be used for normal service while the second feeder is available as a standby or emergency

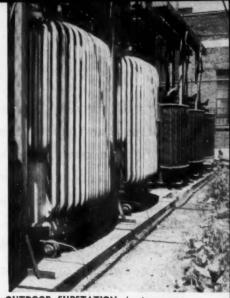
(3) Revamp the primary substation to meet expected future loads rather than to just provide for existing requirements. Since the then-installed overloaded 11/2.3-ky substation had a rating of 4150-kva, it was recommended that two 3000-kva units be installed, with provision for a third unit of similar size if found necessary at a later date. However, taking the longrange view, Rome officials decided to exceed these recommended ratings and installed two 4000-kva units, while still providing space and feeder capacity for a third similar transformer bank if continued load growth warrants.

(4) Establish a uniform distribution level of 2300-volts between main switchgear and substations which are strategically located at load centers within the plant proper. In making this recommendation, the engineer also considered primary distribution at 11-ky and, before making the final suggestion, he designed both systems completely, obtaining price quotations on equipment for both installations. He then analysed overall costs, factors of safety, required capacities for associated equipment such as breakers and cables, considered the area of the plant, possible routing of feeders, locations of substations, distribution of machinery requiring 2.3 kv or 440 v. and other equally important considera-

(5) Provide for the metering of current carried over each separate 2.3-kv feeder, thereby giving a true picture of the kw-demand and highest 15-minute rkva for each section of the plant as well as for the plant in general. With monthly power bills including charges regulated by these 15-minute peaks, this installation of demand meters not only serves to check utility company bills and meters, but also indicates where revised operation of equipment, reconnection of motors or installation of capacitors can be advantageously considered.

(6) Install modern dead-front self-contained double-ended 2300/440-volt substations at loav centers. Here, again, recommendations were exceeded and, instead of approving ten 500-kva transformers, as initially suggested, plant officials approved the installation of two 1000-kva, six 750-kva, one 450-kva and one 300-kva unit; the ten

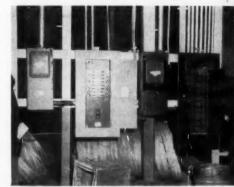
(Continued on page 251)



OUTDOOR SUBSTATION, having space provisions for additional transformers if and when required, is company owned, whereas previously-installed equipment was rented on monthly charge basis from local power supplier.



ELEVATION OF SWITCHGEAR makes additional floor space available for supervisory offices, maintenance depots or storage rooms; promotes safety; simplifies and shortens connections between breaker cubicles and overhead feeders.



MODERNIZATION PROGRAM made use of all previously-installed but still-serviceable equipment; augmenting it with modern panelboards, redistributing feeder and breaker loads, installing additional circuits and relocating control centers.

Large office buildings having major motor loads and general area fluorescent lighting can realize savings in excess of \$25 per kva of demand (and over 20 cents per square foot of rentable floor space) by installing primary 480Y/277-volt systems. Here are some convincing arguments for high-voltage distribution in commercial structures, and some specific economic comparisons.



FIG. 2—FLUORESCENT LIGHTING in general areas of large buildings may be operated on 480Y/277-volt systems economically and safely by connecting lamp ballasts line-to-

D. L. Beeman and H. D. Kurt

General Electric Company Schenectady, N. Y.

VER since the beginning of World War II there has been a growing trend towards the use of 277-volt fluorescent and mercury lighting systems in large industrial plants. Advantages were readily apparent for, with higher levels of illumination being provided, lighting loads frequently amounted to 3 or 4 watts a square foot and, by serving these growing lighting loads from line to neutral of a 480volt system, all except a relatively small amount of power could be effectively supplied through a singlelevel distribution installation. Combining lighting and power systems in this manner resulted in definite economies -related to installation and operating charges alike-and progressive design engineers rapidly adopted the arguments for installing these combined systems. Incidental low-voltage power was supplied as needed through small dry-type transformers, connected to the main 480-volt distribution system at points near the low-potential load centers.

Since the wisdom of 480-volt distribution for industrial applications

Commercial High-

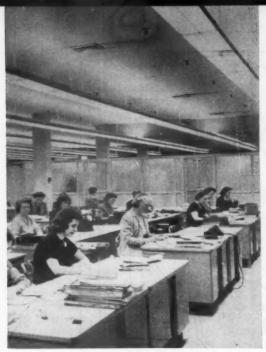
therefore been convincingly proved, it was not illogical to assume that commercial possibilities for highvoltage power distribution might also exist. This assumption was strengthened by analyzing load characteristics in several modern office buildings where, as in industrial plants, it was noted that large motor loads existed in the form of air conditioning compressor motors, air circulating fan motors, elevators, pumps and the like. Also, as in industrial plants, lighting in general areas was found to be mainly fluorescent. Combined, these power and general lighting loads averaged between 4 and 10 watts per sq ft. while incidental power for such items as water coolers, business machines and other small appliances ranged from 2 down to less than ½ watts/sq ft. This analysis indicated that 80% or more of the load in a commercial building might be advantageously served through a 480Y/277-volt system, depending upon availability of power, type of load in the building, configuration of the physical design, and other factors.

During the past years these assumptions have been practically tested in actual installations, and a dozen or more large office buildings around the country already are experiencing highly satisfactory results from the use of combined systems for supplying general light and power.

Availability of Components

In considering the desirability of installing 480-volt systems, with 277-volt fluorescent lighting in office buildings, it is pertinent to note that all necessary components for such systems now have Underwriters' Listings. These components include necessary switching equipment for primary entrances, bus and cable risers, adequately tested and rated panelboards, dry-type transformers for stepping 480-volt power to a level of 120/240-volt for miscellaneous loads, 265-volt ballasts for those types of fluorescent lamps most commonly used for general lighting in office structures, and either 277-volt wall switches (300-v class) or remotecontrol branch switching systems.

Of course, there will always be a



neutral, then switching those circuits through 24-volt remote-control relays.

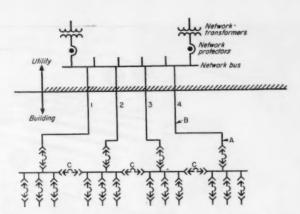


FIG. 1—SHORT-CIRCUIT CURRENT in systems supplied from secondary networks can be reduced by the following:

A=Short-circuit current here should be not more than 100,000 amperes RMS asymmetrical.

B=Wide phase spacing bus thus A B

rated 4000 amperes long enough to reduce short-circuit current at A to 100,000 amperes or less. Each service 1, 2, 3 and 4, rated not more than 4000 amperes.

C=Do not parallel here—If breakers used as shown, operate normally open.

Voltage Installations: Part I

certain amount of equipment in every office operating at 120 volts, such as business machines, floor and desk incandescent lamps, fans, electric razors and other miscellaneous portable appliances. True, a special line of small appliances such as these could be designed for 265-volt operation, thereby eliminating all low-voltage equipment from the premises, but the introduction of a line of this type would be neither feasible nor desirable. In fact, the introduction of a line of this type of equipment, rated for 265-volt operation, would constitute only a small fraction of the low-voltage motor market, would involve considerable development expense and would resultingly have to be priced at a higher level than other already-established items rated for 115/230 volts. With higher voltage to ground, it is also possible that electrical accidents with portable equipment might be more numerous. and, since most of this miscellaneous equipment would belong to tenants, it would create a problem of interchangeability in the event of tenants moving to other buildings. For all of these reasons, therefore, provision for the continued supply of 120-volt current is still desirable; provided either by (1) installing independent 208Y/120-volt unit substations or (2) installing small 480-240/120-volt transformers at local load centers. Of these two methods, the second is the more economical, even when the miscellaneous 120-volt load amounts to as much as 5 w/sq ft. Only in a few borderline cases will this approach overbalance other cost advantages to be derived from installing a basic 480-volt system in the building.

Definition of Voltages

So far in this discussion, we have referred only to 480Y/277 volts as the recommended level for primary distribution in commercial large buildings. This has been done in the interest of consistency, for it coincides with the designation already adopted by EEI-NEMA for industrial power systems. However, it should be noted that many commercial buildings obtain power from utilities at 460Y/265 volts instead of 480Y/277. At first glance, this implies a discrepancy but, when

one considers the range of voltage (plus or minus) normally expected and experienced with the two systems, it becomes apparent that the two different nomenclatures are not critically important; 480Y/277 being merely a maximum, and 460Y/265 being a mean value.

C

So, in order to use all standard motorized equipment now adopted by industry, it is felt that either 480Y/277 or 460Y/265 volt systems should be specified for commercial installations, and, regardless of which of these two nomenclatures is used, (1) supply transformers should have a no-load rating of 480 volts, (2) short-circuit current calculations should be based on this rating, (3) motors and controls are rated 440 volts, (4) capacitors are rated 460 volts, (5) fluorescent light ballasts are rated either 265 or 240-480 volts, and (6) heating devices (for 480-or 460-v use) are rated at 460 volts.

Switchgear Selection

When selecting switching and protective equipment, it should be remem-

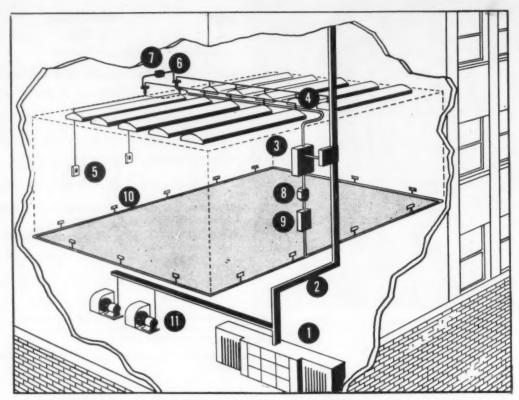


FIG. 3—CUTAWAY VIEW of modern office building having 480Y/277-volt primary installation shows (1) unit substation or main 480-v switchboard, (2) busway riser, (3) fusible plugs for panelboard connection at separate floor, (4) lighting circuits at 277-v line-to-neutral, (5) wall switches that control lighting circuits through 24-volt relay (6) and transformer (7), dry-type single-phase transformer (8) serving 120-v panelboard (9) and floor circuits (10), plus several 480-v line-to-line-connected motors (11) for general building services.

bered that there are several significant differences between 480Y/277- and 208Y/120-volt components. By using properly tested apparatus throughout the system, however, switching at the higher voltage level can be safely and easily accomplished.

Of course, available short-circuit current at 480 volts is not reduced as rapidly as at 208 volts, therefore 480volt switching equipment must be designed to confine the arc within adequate interrupting chambers. This emphasizes the desirability for a better grade of protective equipment on 480volt systems but, as will be seen from a subsequent cost comparison, this does not place an economic penalty on a 480-volt installation. In fact, a positive advantage can be cited, for the reduced effect of circuit impedance at the higher voltage will insure the isolation of a fault in the event of a short circuit.

Short Circuit Protection

So long as short-circuit duty at the main switchboard does not exceed 100,000 amps at 480 volts, adequate protection can be obtained throughout

the entire installation by selecting the following, readily-available equipment.

Service Entrance Switches: Circuit breakers rated at 100,000 may be used for service entrance switches, or high-interrupting-capacity silver-sand fuses may be installed in combination with suitably rated load interrupter switches capable of making and breaking load current and having momentary ratings equal to the let-through currents of the fuses.

Panelboards: Since it is likely that nearly 100,000 amps of short circuit current could reach panelboards protecting branch circuits, this capacity should be specified in the selection of 277-volt panelboards containing 20amp Type AT breakers. In addition, current-limiting fuses with ratings as high as 150 amps should be used on the incoming line. It should be pointed out that this combination will give good protection, although a fault close to the panelboard might blow the 150amp fuses as well as open the circuit breaker for a branch circuit fault. When fusible panelboards are used. silver-sand current-limiting should be employed.

Branch Circuit Switching: Since branch circuits of No. 12 wire have relatively high impedance values, a short-circuit current of 100,000 amps at any panelboard would be reduced to 25,000 amps in a distance of seven feet. For that reason, 20-amp silversand fuses will adequately protect a remote-control relay and may be specified for 277-volt use.

Motor Starters: When motor control centers are used, reactors may be placed in the incoming line section, thereby reducing available short-circuit current from 100 to 25 or 15 kiloamps.

Bus Risers: Available with ICs of 100,000 amps.

In this discussion, it has been assumed that ICs would not be greater than 100,000 amps, although in very large systems supplied from a secondary network bus the short-circuit current might be well above this limit. In that case, however, the IC can be reduced to 100,000 amps by installing service entrances not greater than 4000 amps per entrance, then installing sufficient bus with wide phase spacings between the network bus and the main

switchboard, as illustrated in Fig. 1. In any event, a circuit distance of 30 feet between network bus and switchgear bus should be sufficient to reduce the IC to the desired value. As indicated also in Fig. 1, when buildings have demands exceeding 4000 amps, the service entrances should never be paralleled again in the building, since this might increase the IC at the switchboard bus.

Cost Comparisons

When comparing the costs of 480and 208-volt power systems for commercial buildings, it is important to first review those factors which are affected by system voltage. In this connection-since installation costs vary widely in different sections of the country-we will assume that all installation charges average 25% of the cost of materials being installed. This assumption has proved to be reasonably accurate in past studies, although any accurate study should be corrected in accordance with local conditions. It is important to note, however, that-since a 208-volt system generally has more equipment to be installed than a 480volt installation-the differential will be in favor of the higher voltage as installation costs go up, and in favor of the lower voltage when costs drop.

Before making any specific analysis between the two voltage levels, some general observations can be made concerning:

Main Switching Equipment: For both systems, 600-volt magnetic air circuit breakers are recommended, although the resulting cost differential in favor of the 480-volt system would be slightly reduced if fused switchboards were used. Note, also, that substantial savings can be obtained in the main switchboard of a 480-volt system when full advantage is taken of the facts that fewer feeders carrying more kva per feeder may be used, and that loadings will be lower if the same number of feeders are used.

Main Feeders: It is generally acknowledged that the greatest saving of a 480-volt system is found in the distribution system which might consist either of cable feeders rising to separate panelboards on each floor, or of bus risers equipped with taps at the various levels. Since the same amount of kva can be carried with a smaller voltage drop and less copper in a 480-volt system, savings related to the higher voltage will go up as the loads increase and the runs become longer.

Panelboards: Whether or not there will be savings in panelboards depends

on the number of circuits being controlled for, in general, a 277-volt panel-board will be more expensive—per circuit—than a 125-volt panel. Since we are going on the assumption that 120-volt current will be provided regardless of whether the lighting is 120- or 277-volt, it is to be expected that the cost of panelboards will be in favor of the lower voltage.

Dry-Type Transformers: Savings to be obtained with a 480-volt distribution are so considerable that, even when the ratio of 120:480-volt loads is high and the number of auxiliary dry-type 480-120/240-volt transformers is large, the comparison still favors a 480-volt installation. Generally, however, miscellaneous 120-volt loadings are low, in the order of 0.5- to 2 w/sq.ft., so that required dry-type transformers wipe out only a fraction of the savings.

Branch Circuits: As is the case with main feeders, considerable savings are obtainable by fully loading branch 277-volt circuits for general area lighting use. This saving will usually offset the higher cost of panelboards.

Remote Control: Whether 24-volt remote-control wiring or wall switches are installed for switching general area lighting circuits, there will be no saving, since relays and wall switches will be approximately equal.

Luminaires: Provided modern rapid start or instant start ballasts are used, there should be no significant difference in the cost of fixtures installed in large buildings.

Motors: With the exception of airconditioning compressors larger than 500-hp, motors rated for either 208, 220 or 440 volts cost the same. However, a 440-volt motor will involve savings in control charges and, considering motor starters as a separate item, these savings will be considerable.

Compressors: Where steam is available for driving air-conditioning compressors, this item does not enter our comparison. However, where compressor motors are required, savings favor the 480-volt system,

Local Considerations

Of course, if 480- and 208-volt services are both conveniently located no problem will arise as to availability, although a charge of about \$8 per kva of building load will be involved if only 208-volt is available and must be stepped up to the higher voltage through auto-transformers.

Another factor affecting the comparison between 480- and 208-volt systems is physical configuration, since a tall, narrow building, involving long risers, obviously would favor 480-volt

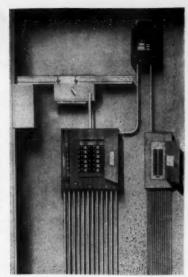


FIG. 4—COMPACT ARRANGEMENT of equipment in typical electrical closet shows busway riser and plug-in switch, 277-v fused panelboard, dry-type single-phase transformer, and 120-v circuit-breaker panel for receptacles.

distribution, while a wide-area, compact structure would minimize the savings related to feeder lengths.

Aside from these two considerations there are few other major restrictions to the practical use of 480-volt distribution with 277-volt general lighting circuits, for most local codes, plus the NEC, now approve this approach.

Of course, a factor having an important bearing on the practicality of using 277-volt for general lighting is the type of tenancy in the building for, where many tenants occupy each floor and where current is submetered to these many individuals, it would be reasonable to operate lighting circuits at 120 volts. On the other hand, where the number of tenants per floor is limited and fixtures are bought in quantity by the owner for general lighting use, 277 volts for lighting is practical as well as economical.

Current Characteristics

In summarizing this preliminary comparison between 480- and 208-volt systems, it should be stressed that the wattage losses in 480-volt risers will be materially less and, even when the losses to be encountered in the use of small step-down transformers are included, total system losses for the higher-voltage systems will be smaller.

Voltage drop, also, will be less in the risers of a 480-volt system.

These general considerations will be more fully explained in Part II with specific cost comparisons.

Technical Data On Fluorescent amps And Luminaires

	Lamp Date	ata		1-Lar	1-Lamp Luminaire	aire	2 Lan	2 Lamp Luminaire	ire	4-Lai	4-Lamp Luminaire	sire
Туре	Length	Watts	Current	Lumens	Watts	L/W	Lumens	Watts	L/W	Lumens	Watts	L/W
40WT12.	48-in	40	410 ma	2,500	51	49.0	5,000	8	50.5	10,000	198	50.5
40WT17	60-in	40	410 ma	2,500	51	49.0	2,000	66	50.5	10,000	198	50.5
90WT17	60-in	06	1500 ma	5,150	115	44.8	10,300	218	47.3	20,600	436	47.3
72T8	72-in	37	200 ша	2,450	53	46.3	4,900	66	49.5	008'6	198	49.5
96Т8	96-in	49	200 ma	3,450	69	20.0	9'900	130	53.0	13,800	260	53.0
7218	72-in	49	300 ша	3,200	70	45.7	6,400	135	47.4	12,800	270	47.4
96T-8	96-in	69	300 ma	4,500	8	20.0	000'6	176	51.2	18,000	352	51.2
48T-12	48-in	36	430 ma	2,350	58	40.6	4,700	104	45.2	9,400	208	45.2
48T-12	48-in	38	430 ma				4,700	*86	48.0	9,400	196*	48.0
72T-12	72-in	55	430 ma	3,550	80	44.4	7,100	143	40.6	14.200	286	49.6
72T-12	72-in	55	430 ma				7,100	138*	51.4	14,200	276*	51.4
96T-12	96-in	74	430 ma	5,100	103	49.5	10,200	188	54.4	20,400	376	54.4
96T-12	96-in	74	430 ma				10,200	176*	58.0	20,400	352*	58.0

* Based on 2-lamp series start ballasts. All other data are based on lead-lag type ballasts.

NOTE: Lumen data in this Table are based on light output of standard warm white fluorescent lamps at 100 hours. To obtain lumen data on fluorescent lamps of other colors, use the following correction factors: A—White (3500°K)—1.00; B—Daylight (6500°K)—0.84; C—Standard Cool White (4500°K)—0.94; Deluxe lamps—0.75 (of Standard Warm or Standard Cool White Lamps).

Data By: San Francisco Division Sales Dept., Pacific Gas & Electric Company



MORE THAN 100,000 ELECTRICAL ITEMS are available from nearby Graybar... complete wiring systems for commercial and industrial needs...apparatus for power distribution...

indoor and outdoor lighting units and lamps . . . ventilating, signaling and "intercom" equipment . . . plus cable, conduit, wiring devices and tools needed to install them.

If it's electrical...get it from Graybar

"extra"
reasons
why
your next
order
should
read "via Graybar"



PRICES AND "SPECS" on everything electrical not only from our own comprehensive catalogs, but from those of 300 supplier-manufacturers.



GRAYBAR SPECIALISTS in all of the major electrical fields to work with you in planning out-of-the ordinary projects.



COUNTER SERVICE for emergency or pick-up orders plus prompt information from experienced personnel.

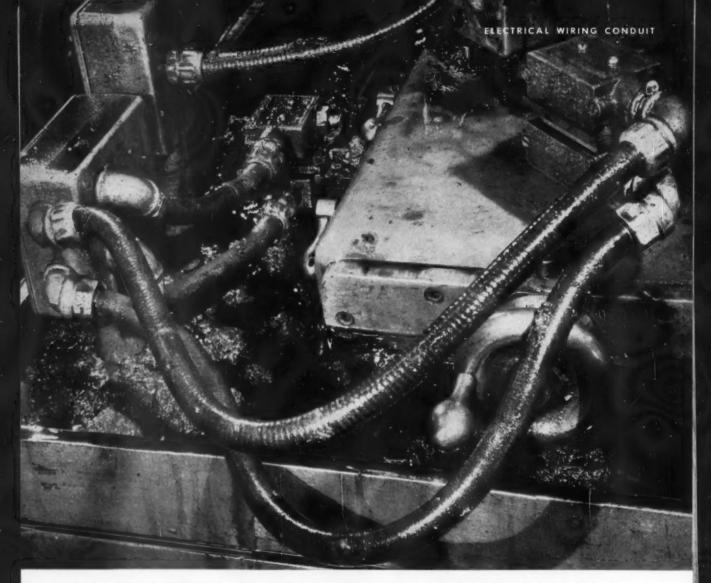
CALL GRAYBAR FIRST FOR ...

GravbaR ELECTRIC CO., INC., 420 Lexington Avenue, New York 17, N. Y.

IN

IN OVER 110 PRINCIPAL CITIES

See the following pages for more information about items manufactured by typical Graybar suppliers.



PRODUCTION GRINDER IS TOUGH TEST for wiring conduit. SEALTITE passes easily ... protects against grinder dust, oil, coolant, and movement.

Tough synthetic cover on this conduit keeps these control wires working

IT'S SEALTITE* ELECTRICAL WIRING CONDUIT ... PROTECTION AGAINST ENEMIES OF WIRING SEALTITE was made to handle trouble. Oil and grease. Weather, water and dirt. Chemicals, corrosive fumes and salt spray. None gets by SEALTITE'S synthetic jacket. Wiring can't be damaged. Protection is complete.

But SEALTITE offers more than just toughness. It is light and flexible. It installs easily in cramped spaces. It ab-

sorbs vibration-takes movement. And it hugs motor contours . . . looks neat.

Liquid-tight SEALTITE Type U.A. is the first conduit of its type to be approved by Underwriters' Laboratories, Inc. for use where exposed to moisture and mineral oils. (See N.E. Code, Art. 351.) For tight bends on machine tools and industrial equipment, use SEALTITE Type E.F.† (Extra Flexible). It meets standards set by J.I.C.

Electrical wholesalers stock both types in coils. Buy it this way; then cut without waste. Wholesalers also stock liquid-tight connectors for use with SEALTITE.

*Trademark 54173 Gr. †Patent Applied For

SEALTITE

flexible, liquid-tight electrical conduit
an ANACONDA product





HERE'S ANOTHER QUALITY
PRODUCT AVAILABLE VIA
GRAYBAR





ST Series Liquid Tight Connectors



"MHILETS"

Malleable Iron Unilets— FS and FD Series



Outlet Boxes

The Industry's Most Comprehensive

QUALITY LINE

More Than 18,000 Items to Choose From -



Industrial Diskonect Reflector



Switch Boxes



Reelite
Automatic Extension Reels



V-51 Series Vapor-Tight Fixtures

ALL from one source!

• Whatever you need in the way of electrical fittings, malleable iron Unilets, lighting fixtures or roughing-in material . . . your most complete selection is from Appleton. And from a thread in the simplest fitting, to the machining of the copper collector rings on a Reelite, every stage of production is under the most rigid inspection to produce the utmost in quality.



AA-51 Series Explosion-Proof Fixtures

APPLETON

not only brings you your best quality line, but simplified stock control, standardized profit margins and satisfied customers. It's the line preferred by architects and contractors. Next time you replenish stocks, get *Appleton!*

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

1704 Wellington Avenue . Chicago 13, Illinois





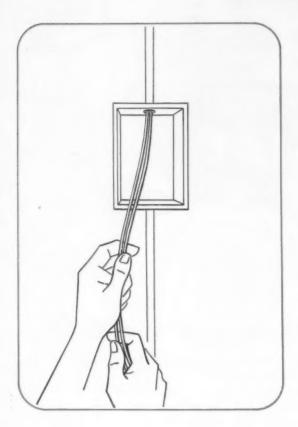
HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR

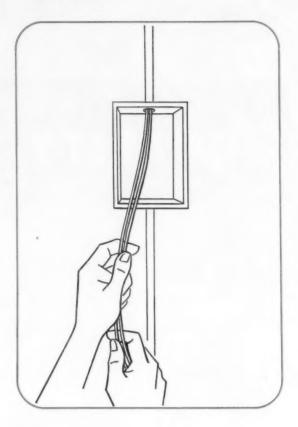


HE SAME WIR

IN LOOKS, YES.

IN PERFORMANCE, NO.





Feel the slicker finish on AnacondA TW - the easiest fishing wire today. It costs not a penny extra.

Most building wire may look alike . . . but there can be a whale of a difference in the way two wires handle.

Here's why we suggest you give ANACONDA Type TW a try:

It has a new "slipper" compound—applied just before packaging. It's smoother. You can fish this wire faster. You don't need pulling compounds. And no matter how long the wire has been around, the "slipper" doesn't lose its slickness. It won't harm insulation.

ANACONDA Type TW is the answer to many tough rewiring jobs. With its new slick finish, it fishes more easily through rusty, partially clogged conduits.

A sample will convince you. Ask your Anaconda Sales Office or distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

the right cable for the job

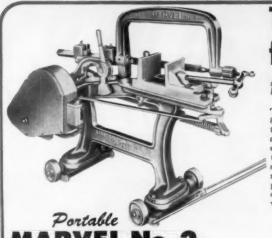
ANACONDA® WIRE AND CABLE





HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR





MARVEL No.

DRAW CUTTING HACK SAW MACHINE

The best metal-cutting saw for the shop the best to have on the job

The MARVEL No. 1 (capacity 4" x 4") and the MARVEL No. 2 (capacity 8" x 8") Portable Hack Saws are the logical metal-cutting saws for electrical work both in the shop and on the job. They load easily on a truck and go to the point of work on their own wheels. They take the fasterand go to the point of work on their own wheels. They take the laster-cutting high speed steel blades and permit really effective feed pressures. (You don't have to wait to scratch your way through conduit, pipe, shapes or bars with these general purpose industrial hack saws, they really race through steel.) In their rigid frames, blades can really be pulled taut, and will cut straight and accurately. The No. 2 saw has a quick-action vise that swivels to permit angle cuts up to 45°; and in every way it is-

Fast . . . of high speed steel blades.

because the improved Saw Frame with clamping type Accurate... blade holders holds the blade in perfect alignment and proper tension.

because of its automatic relief on the return stroke, the Economica . . . blade will last and last and last.

because modern high speed steel blades will operate effi-Dry Cutting . . . ciently at 60 strokes per minute without a coolant.



MARVEL High-Speed-Edge Hack Saw Blades will out-cut all others because they have the finest high speed steel cutting edge. They will out-last other high-speed steel blades because they will not break or shatter—have a tough alloy steel body. By develop-ing this composite construction, MARVEL produces a superior blade that will stand up under any speed, feed and tensioning. indefinitely. And fast, accurate, economical metal-sawing is possible only with high speeds, heavy feeds and a really taut saw blade. All sizes.

MARVEL High-Speed-Edge Hole Saws, because of this same MARVEL composite construction, have sufficient strength for use on drill presses and lathes as well as in portable hand drills. They will saw out holes at low cost in any machineable material (will go through steel plate up to 1½ " thick) easily and quickly. Until you've used a MARVEL Hole Saw you just can't know hole saw possibilities. Diameters from 3/8" to 41/2

MARVEL Splitting Shears

Economically and accurately cut-off, split and trim flat steel plates and bars.



odei	No. 1	No. 2
pacity (mild steel)	1/8"	1/4"
ngth of shear blade	4"	6"
ngth of lever	30"	54"

MARVEL Rod Cutters



Model	Will cut Round Rods (dia.)	Weight, Ibs.
No. 5	3/8, 5/16, 1/4, 3/16, 1/8	15
No. 6	\$/8, 9/16, 1/2, 7/16, 3/6	45
No. 7	1/4, 3/4, 3/4, 1/2, 3/4	110

MARVEL Drill Press Vises

The sliding jaw is quick action—ratchets and screws tight. For drill presses, milling machines and shapers.

Model	No. 40	No. 41
Capacity	5"	8"
Width of Jaws Height of Jaws	5 1/2"	7"
Overall length Overall width Overall height	12½" 5%" 4¼"	17½° 7″ 6″



ARMSTRONG-BLUM MFG. CO. · 5700 Bloomingdale Ave. · CHICAGO 39, ILL.











HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA GRAYBAR





• Beaver machines are made with lathe-like precision, yet are as rugged as power shovels. They can be depended upon to "deliver the goods" job after job . . . no costly down time for repairs or adjustments. When you buy a Beaver, you're assured of a quality product, manufactured by an experienced company. That's why we say "Buy a Beaver and forget about it!"



CHECK THESE AMAZING BEAVER FEATURES! The BEAVER Model "A" Pipe and Bolt Machine,

● Right-handed operation . . . like a lathe. • All controls in front . . . at finger tips. • Chuck to the left, tool mounting to the right. • All gears run in oil. • Inverted chip-free rack-and-pinion feed. • Full 12-inch open working space. • Heavy-duty 1/8 to 2-inch chuck. • Swinging arm 1/8 to 2-inch reamer. • Oil pump accessible for easy cleaning. • Ring-type adjustable quick-opening die heads—no hinge to get fouled with chips. • Choice of ball-bearing wheel-and-roller cutoff or automatic cutoff. • Units are interchangeable. • Motors available in all types and voltages. • Ample power to cut and thread up to 12-inch pipe. • Patented outboard pipe rest and safety switch lock. • Net weight about 370 pounds. • More than 200 different kinds and sizes of dies available!

BENER

282-300 Dana Ave. . Warren, Ohio, U. S. A.

"53 Years of Highest Quality"

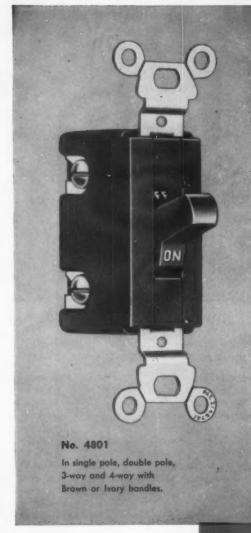






Cut Job Costs with this New Bryant A.C. QUIET SWITCH

Rated 15 Amperes, 120 Volts . . . 15 Amperes, 277 Volts



The new 4801 line of Bryant A.C. switches offers you radically new and improved features now permissable under recently adopted Underwriters' and Code Standards. For commercial, institutional, industrial and residential applications look to this quality-built Bryant switch for lower wiring costs and vastly improved electrical service . . . here's why —

- The 4801 is the first switch permitting full ratings for use on fluorescent (inductive) loads. The 15 Amperes at full rating use means triple that of existing 10 Ampere switches for these applications. This means fewer switches and lower job costs.
- Capable to the full rated capacity for tungsten filament lamp loads.
- New 277 Volt rating provides for the popular 4-wire 480/277 Volt distribution system now being specified in many areas.
- 4. The 4801 is ideal for Motor Control, safely handling full load currents up to 80% of the switch rating.
- Much longer life due to rugged construction and use of fine silver contacts.
- Back wiring using full screw-clamp type of fastening already proved in installations, or conventional side wiring.
- Extremely quiet . . . almost silent . . . due to unique mechanism design.
- 8. Every modern feature . . . strength, . . . fully enclosed . . . easy, smooth operation . . . takes up to #10 wire . . . operates in any position.

Specify Bryant From Your Electrical Distributor

Listed by
Underwriters'
Laboratories, Inc.



THE BRYANT ELECTRIC COMPANY

Bridgeport 2, Connecticut

Chicago . Los Angeles

9989







This <u>hydraulic</u> equipment keeps my men happier...more productive"

TO BEND RIGID OR THIN-WALL CONDUIT

A Blackhawk hydraulic bender creates striking savings! It's really portable . . . and just plain handier! Works in any position — on its side or upright, on table or floor, on existing runs. With the hydraulic pump and ram separated by a flexible hose, a man can move around — "jockey" the pipe with one hand — sight along it if necessary . . . without stopping the pumping.

TO DRIVE KNOCK-OUT PUNCHES

Look! No wrench to swing. No knuckle busting. No more distorted boxes. Now you can drive knock-out punches with the amazing "Porto-Power" hydraulic jack. It's 60% faster! Conduit openings are neat—workmen are happier, safer—dies last six times longer!

TO LIFT MACHINERY, PULL PULLEYS

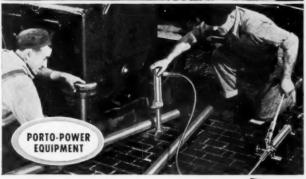
The same "Porto-Power" hydraulic jacks that serve Blackhawk Electrician's Equipment lick dozens of allied jobs. With its all-directional ram, it can lift, pull, press, clamp, bend or push. "Porto-Power" wipes out scores of time-wasting construction and maintenance methods. Don't do it the hard way — do it the hydraulic way!

Yes, Blackhawk hydraulic equipment will make your crew happier, more productive. Today more than ever, it's important to give your men the best tools possible. And if you want to motorize your hydraulic equipment, the inexpensive P-182 portable electric pump provides finger-tip control,

cuts manual labor, triples output. Order Black-hawk equipment from your wholesaler.







CLIP	THIS	COUPON	AND	MAIL	TODAY!
BLAC	KHAV	VK MFG.	CO.		

Dept. P-2044, Milwaukee 1, Wis.

Please rush free Catalog 50B on Blackhawk Electrician's Equipment

irm.

BLACKHAWK

HYDRAULIC PORTO-POWER EQUIPMEN









HYPRESS

Cost comparisons by Busch Bros., Inc., electrical contractors for New Jersey's new Linwood Park Housing project, showed savings on Hydent connectors, (against cast connectors) more than paid for the Hypress.* On future jobs, savings will amount to more than 80% of former connector cost. Even against the most economical type of bolted connector, savings will average 40% - 50%.

*Itemized cost comparison on request.

Write for Burndy
Hydent Catalog Y53
and find out how you
can connect with savings.

BURND

NORWALK, CONNECT.

FACTORIES: New York, California, Toronto EXPORT: Philips Export Corporation

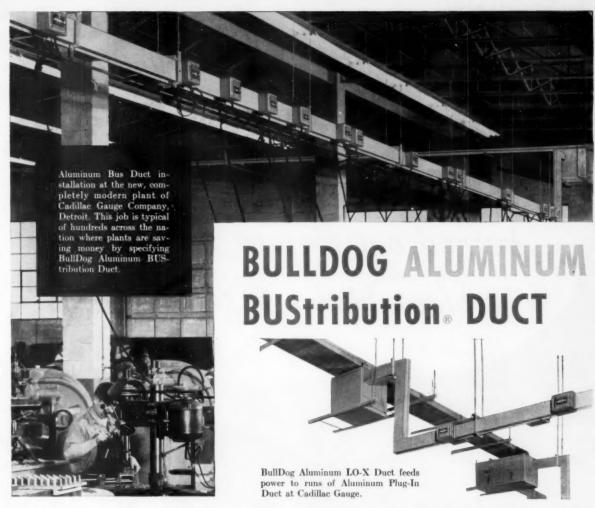
TORONTO, CANADA

53-9









Everything* you expect in bus duct!

*PERFORMANCE: If you're looking for safe, efficient, low cost electrical distribution, check into BullDog BUStribution Duct with aluminum bus bars. Seven years of exhaustive research and hundreds of actual installations prove that aluminum bus duct will provide trouble-free, economical, and efficient performance. Aluminum is no experiment or substitute—it is here to stay. Aluminum bus duct is listed by Underwriters' Laboratories, Inc., and carries the same guarantee as BullDog's other systems.

*INSTALLATION: Runs of aluminum bus

duct can result in a considerable weight savings. This light weight, plus BullDog's patented scarf-lap joint, makes installation simpler, faster, more economical. Like all BullDog BuStribution Duct Systems, aluminum bus duct is completely reusable. It is completely interchangeable with other BullDog Duct Systems, plugs and accessories.

***ECONOMY:** Because you save in the original purchase price, in installation and operation costs, BullDog aluminum bus duct brings you the lowest possible current-carrying cost per ampere per foot.

Get complete information on Aluminum LO-X Duct (for feeder and welder circuits) and Aluminum Plug-In Duct (for branch circuits). Consult your local BullDog Field Engineer, or write BullDog Electric Products Company, Dept. EC-44, Detroit 32, Michigan.



THOROUGHBRED IN ELECTRICAL EQUIPMENT

BULLDOG







"We were losing as many
as six hoist motors a year—
now instead of rewinding
burned out motors we simply
replace blown Fusetron Fuses"













WE have two 1 ton hoists that are subject to very heavy loading. The motors on these hoists are 220 volt, 60 cycle, 3 phase type with a running current of about 3.7 amperes.

"Whenever the hoists are overloaded an excessive current is drawn by the motor. We have lost as many as six motors a year because of this.

"In the fall of 1952 we replaced all fuses protecting the motors with 4 ampere, 250 volt type FUSETRON dual-element fuses.

"Since then we have blown three sets of FUSETRON fuses but have not lost a single motor.

"So now instead of rewinding motors we simply replace blown FUSETRON fuses.

"They are a lot cheaper than a motor repair job — and we don't have our hoists shut down but for a few minutes while the fuses are replaced."

W. F. Fuertges

Production Superintendent, Hotchkiss Steel Products Co, Bradford, Ill.



FOR MORE INFORMATION use this Coupon







City & Zone



ECM4-54



Brady Pressure-Sensitive Wire Markers for small gage wires are exactly 3/4" long to fit wires under 1/4" O. D. Here's why they cut your small gage wire marking costs in half:

- 1. They cost half the price of standard size wire markers, and
- 2. They go on the wire twice as fast.

Remember, you can't drop Brady Wire Markers — they stick to your finger from Card to wire. You don't take twice the time removing troublesome tabs from each and every Marker in order to get it to stick to the wire. Only Brady Markers come ready to use! Over 2,000 different stock Markers—both standard and small gage sizes. Specials made to order. Start cutting your costs in half right now. Write for your free sample Card of Brady small gage Wire Markers today!

W. H. BRADY COMPANY

793 W. Glendale Avenue • Milwaukee 12, Wisconsin

NO. 1 NAME... NO. 1 SOURCE BRADY

Pressure-Sensitive Industrial Products







fill all your portable hoist needs from one reliable source

OVER A HUNDRED SIZES AND MODELS OF COFFING HOISTS

CLEVIS-CONNECTED HOISTS

eleven models— 1/4- to 10-ton capacities

SPUR-GEAR HOISTS (single chain)



eight models — 1/4- to 2-ton capacities

SAFETY-PULL RATCHET LEVER HOISTS

10 roller-chain models — 1,500- to 30,000-lb. 2 coil-chain models 1,500- and 3,000-lb. MIGHTY-MIDGET PULLERS

two sizes — 500- and 1,000-lb. capacities

QUIK-LIFT ELECTRIC HOISTS

17 models — 500- to 4,000-lb. CHALLENGER LIGHTWEIGHT ALL-STEEL SPUR-GEAR HOISTS

three models — 1/2-, 1-, and 2-ton capacities SAFETY LOAD BINDERS

2 models — 3,000- and 6,000 lb.

Also HOIST BINDER

3,000-lb.

EXTENDED HAND-WHEEL HOISTS

> six models — 1/4- to 3-ton capacities

Also ARMY-TYPE HOISTS

(plain and geared)
11 models —
1/4- to 10-ton

HERENE LAND

SPUR-GEAR HOISTS

(multiple chain) fourteen models – 3- to 25-ton capacities CHAIN HOISTS

two sizes —

1/2- and
1-ton
capacities

HOIST-ALLS

two sizes — 1-, and 2-ton capacities LOW HEADROOM HOISTS

12 models

— 1½- to
24-ton
capacities

The broad Coffing line lets you select exactly the right hoist for the job. For more information on units you need, see your distributor, or write Dept. EC4.

COFFING HOIST COMPANY

DANVILLE, ILLINOIS

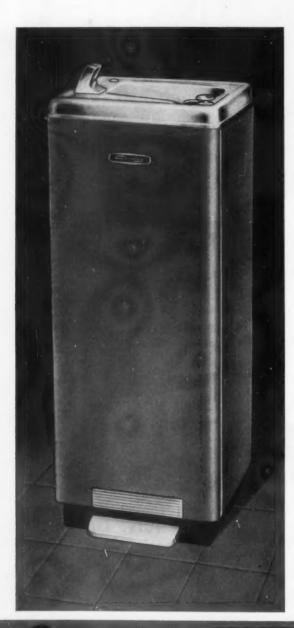
Car-you











MORE THAN 20 MODELS for DRINKING WATER NEEDS

The diversified line of more than 20 Cordley Electric Water Coolers includes a size and type for every industrial or commercial drinking water need.

- · bubbler and bottle types for general uses
- · water-cooled types for textile mills, etc.
- · high-capacity types for steel mills
- explosion-proof types for combustible areas
- refrigerator types for beverages, etc.
- · remote types for existing drinking outlets

MATCHLESSLY RUGGED

Good looking to be sure but more important to every user, Cordley Electric Water Coolers are built extra strong for more years of service. That's why they carry a broader guarantee than any other water cooler in the industry.

comprehensive five-year warranty

IN addition to many other unique features, every user of Cordley Hermetic Electric Water Coolers is protected for a period of five-years from the date of installation. This warranty covers replacement of the entire cooler if a defect occurs within the hermetic factory-sealed refrigerant system or the cooling tank. Copy of the complete warranty will be supplied upon request.

SEALED SYSTEM-LONGER LIFE

Every Cordley Hermetic Electric Water Cooler is equipped with a completely sealed refrigerant system. All lines connected securely—joined by silver solder into one continuous circuit to ensure dependable and longer service.

YOU CAN MAKE MONEY WITH WATER

Perfectly cooled water is profitable regardless of your business. It keeps employees healthy, alert, clear thinking—and when strategically located saves time and money wasted in treks to less accessible or out-of-sight sources. It improves customer relations by thoughtfully providing a refreshing drink in showrooms, reception rooms, etc.

NEW CATALOG AVAILABLE

See the complete line of Cordley Electric Water Coolers in the new catalog just off the press. Ask for it today.







the new IRIS industrial

Side Reflectors hinge dawnward and may be completely removed for ease of maintenance.

6000 Series

The New Curtis "Six Thousand" series is designed for Eye-Comfort® in industrial locations. The Luminaires illuminate the ceiling with an indirect component of 25% of the light output. Crosswise shielding of 35° is provided for the 75% direct component. The lighting units in this versatile line are available with Alzak Aluminum, Porcelain Enamel, or baked white "Fluracite" enameled steel removable side reflectors. Low cost efficient maintenance is provided by having side panels readily removable for cleaning. In addition there are no horizontal diffusing or reflecting surfaces to collect dust. There is a unit in this versatile line to accommodate all 4', 5' and 8' fluorescent lamps. The Curtis "Six-Thousand" series brings Appropriate Brightness Control Lighting to industrial areas. Mail coupon for FREE descriptive literature.

25% Direct
Light distribution eliminates severe brightness contrast and tunnel lighting conditions.

15% Indirect

Louvers available where greater lengthwise shielding is desired.



Curtis "Tong Hangers" facilitate and cut installation cost as they allow flexibility in placement of hangers and permit bypassing of building construction obstacles such as beams, sprinkler heads, etc.

*Pat applied for

CURTIS LIGHTING, INC. Dept. D12-20 6135 West 65th Street Chicago 38, Illinois

Name_____

Company

Address

HERE'S ANOTHER QUALITY PRODUCT AVAILABLE VIA

GRAYBAR





LOOK AT DAY-BRITE



VIZ-AID® Standard of the industry. One of the most imitated commercial fixtures on the market. In Rapid-Start, 2- and 4-lamp units.





FEEL THE DIFFERENCE





... BEFORE YOU BUY

This is just a glimpse of the nation's leading line of lighting fixtures. Whatever the lighting job, there's a quality Day-Brite fixture to do it—not just as well, but better!

Best way to have the full picture of the Day-Brite line is to have an up-to-date catalog. If you don't already have one, write to the address below.

DAY-BRITE LIGHTING, INC., 5402 Bulwer Ave., St. Louis 7, Mo. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ontario.



448



Alzak aluminum parabolic unit with sensational new PARA-LOUVERS —reduces lengthwise brightness up to 50%.









ECON

Dual-Element Cartridge FUSES

Why this announcement is important to YOU:

(1) OFFERS GREATER PROTECTION FOR ELECTRICAL CIRCUITS

Wherever overloads are likely to occur, ECON Dual-Element Fuses now bring the time and money savings that result from positive, dependable controlled protection against unnecessary blowouts — as well as against short circuits. The unique design and construction of the ECON Dual-Element also insures better protection against single-phasing, eliminates the necessity of over-fusing, and results in cooler fuse holders and switches.

(2) MAKES THE ECONOMY LINE MORE COMPLETE THAN EVER

In keeping with the policy of offering "Fuses for Every Purpose," Economy is constantly adding new and improved fuses and other circuit-protection products to help solve unusual fuse problems. Thus, Economy Fuse & Manufacturing Co. rounds out its line still further with a new dual-element fuse that offers many special features and advantages.

Write for New ECON Dual-Element Cartridge Fuse Catalog, S-60 or for literature on other type fuses.

Your Electrical Wholesaler has ECON Dual-Element Cartridge Fuces in stock

ECONOMY fuses for every purpose

ECONOMY FUSE & MANUFACTURING CO.

P-464R 2717 GREENVIEW AVE.

CHICAGO 14. ILLINOIS







Install EDWARDS

and your jobs will never haunt you!

You can really depend on Edwards installations. 80-odd years experience in designing and engineering precision products for home and industry has given us more than a little know-how! Edwards reputation for building rugged, trouble-free, easy-to-install, advanced-styled equipment is tops in the field, your best guarantee of customer satisfaction! By specifying the Edwards line, sold only through distributors, you build your own prestige and profits.

Rells and Buzzers

More than 10 million of these Bells, Buzzers and Buzabell combinations have been installed all over the world! Inexpensive, well-designed, simple to mount. Handsome satin aluminum finish, snap-on covers. Built for 6 to 8 volt 60 cycle AC, transformer operated ... 3 to 6 volts DC, battery operated.



DIXIE BELL Completely enclosed. May be installed with exposed wiring.



NUBEL Exposed gong, enclosed binding posts and mechanism.

The Lungen Line



Fine quality, attractive-looking bells and buzzers . . . durable and trouble-free . . . dust resistant . . . easily adjusted for wide range of volume and tone. Cadmium, with lustrous chrome covers. Concealed, and external binding post types. Designed for 6 volts DC or 8 volts AC.



Low Voltage Push Button



Edwards famous "No. 620". . . one of the world's most widely used flush push buttons! Positive, self-cleaning contacts. Mounts in %" hole with spring clips.

Easi-Mount Transformer



A new, speedily installed universal transformer for chimes and door bells. Approved by Underwriters' Laboratories. Mounts to any half-inch knockout with expandable nipple, Edjustable by an outside set screw. Can also be surface mounted.

ADAPTABEL



By actual test-140% louder than any other bell of same size! Clear, farcarrying ring is free of mechanical clatter. Rugged construction . . . no moving contacts or springs to replace . . automatic compensation for plunger wear! Listed by Underwriters' Laboratories. Available in 4", 6", 10"

Loudness Factor					
nize	decibles*	Loudness units			
4 inch	1 77	13,500			
6 inch	83	21,400			
10 inch	89	35,000			
	*at ten feet				

ADAPTAHORN



Amp for amp . . . the loudest horn on the market! Overcomes unusual noise levels, giving sound coverage over wide areas. Can be pitched from a whisper to a bellow . . . never loses its adjustment. Severe life tests prove this! Sealed in mechanism . . . no dust and dirt can penetrate. Approved by Underwriters' Laboratories.

Loudness Factor					
type	decibles*	loudness units			
flush	94	52,000			
projector	91	40,000			
grille	98	80,000			
	at ton foot				

WORLD'S EASIEST MOUNTED SIGNALS! SAME MOUNTING PLATE FITS BOTH ADAPTABEL AND ADAPTAHORN!



1. Mount plate on wall or outlet box. Elongated holes make it easy to line up.



2. Pull wire through spacious center hole and connect to large binding posts.



3. Slip signal on to sturdy hanger, push home and tighten tamperproof screw.

Company Inc.

Dept. E. C. M. 4, NORWALK, CONN. In Canada: Edwards of Canada, Ltd.









ELECTRIC FEEDRAIL, with its conductors enclosed in metal housings, eliminates the hazards of exposed wiring and trailing cables. It provides safe power for hoist and crane operations and for conveyors. Its long life and continuous trouble-free service cuts maintenance costs to a minimum.

FEEDRAIL readily fits into your specific requirements. Its standard-ized components—accurately and ruggedly constructed—make for fast, easy installation. It's the safe, convenient, adaptable system for modernizing as well as new construction.

Write for descriptive literature. Address Dept. C-4.

Available in standard-length straight, curved and transfer track sections, FEEDRAIL is "tailored-to-fit" practically any crane, hoist or conveyor application. FEEDRAIL systems are available in 60, 100, 225, 375 and 500 amperes.

Name of nearest representative on request.

ELECTRIC FEEDBAIL® Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET . NEW YORK 7, N.Y.

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES







Efficiency



SUSPENSION DEVICES

ARE TIME AND COST SAVERS

By eliminating the need for punching, drilling or burning through beams in order to hang electrical mountings... Efficiency Suspension Devices can save you time and expense on practically every construction job.

BUSHING SUPPORTS







YPE G

TYPE VG

TYPE VE

Designed to eliminate the drilling of holes for mounting, these supports are adjustable to any angle. Made of malleable iron with highest quality split porcelain, they are turnished for AC-DC service to handle 5/16" to 24,6" cable. Type G is clamp-mounted, while Type VB and VG bolt mounted through its circular base.

BUSHING RACKS AND SUPPORTS







Available in 2, 3, 4, 5 and 8 bushing racks for AC or DC service. Only a single bolt is required to support the bushing and clamp the support to the rack. For 5/18" to 2\%" wire sizes.

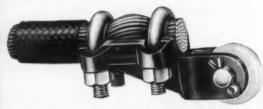


NESTED BUSHING RACKS AND SUPPORTS

Simply and compactly designed to carry conductors equidistant from center to center. Each bushing is a separate unit, allowing independent installation of each cable line. Available in 2, 3, 4, 5 and 6 bushing racks.

CABLE STRAIN CLAMP

Capable of withstanding a direct pull of over 12,500 lbs. before slipping, this clamp can be furnished either with eye or clevis. Three clamp sizes accommodate all cable sizes from 1/0 to 1,500,000 c.m. Constructed of malleable iron, this clamp has a high ridge across the center of the cable channel and a U-bolt at each end.



EFFICIENCY ELECTRIC AND MANUFACTURING COMPANY

Write for Catalog

East Palestine, Ohio







Slim, trim and functional in appearance, the Garcy Starliner lends itself beautifully to contemporary styling. When surface mounted, its shallow contour economically simulates built-in lighting. Yet within its compact design, this luminaire embodies every wanted feature. Side panels of Corning's Alba-lite glass are attractively framed in protective metal rails . . . promote efficient light distribution while contributing to proper brightness control. Garcy's louver design provides 30° x 40° shielding. The Starliner is superbly made . . . note the round edges on end plates and side rails. Economically installed, easily maintained. Available as two-lamp or four-lamp units in 4 ft. or 8 ft. lengths for standard fluorescent, rapid start or slimline lamps. Write for Bulletin L-134.



GARDEN CITY PLATING & MFG. CO.

1730 N. ASHLAND AVE., CHICAGO 22, ILLINOIS

IN CANADA: GARCY CO. OF CANADA LTD., 191 NIAGARA ST., TORONTO

FAST, LOW-COST INSTALLATION with Garey Sliding

with Garcy Sliding Clamp Hangers for easy alignment, both vertically and horizontally. Adjustable in height by simply turning stem.



ECONOMICAL MAINTENANCE

Single louver shield permits relamping two 8 ft. fixtures from one ladder position.



STURDY

V-shaped backbone securely holds louver cross-fins under spring tension . . prevents looseness, rattle or "sing."











UNIT PACKAGE

SPLICING KITS

ENGINEERED FOR BETTER CABLE JOINTS

WHEN YOU ORDER CABLE SPLICING MATERIALS SEPARATELY YOU WASTE TIME AND MONEY GOING THROUGH ALL THE FOLLOWING STEPS—

- Design the joint. Figure the bill of material.
- elssue requisitions to purchasing department.
- Find sources of supply for each item.
- •Get quotation and delivery promise on each item.
- · Place order for each item.
- Receive materials and assemble.
- elssue materials to cable splicers.

WHEN YOU ORDER CABLE SPLICING MATERIALS IN UNIT PACKAGE KITS YOU SAVE TIME AND MONEY BECAUSE—

- Time and expense of securing various items from different sources is saved.
- No lengthy material specifications are necessary.
- Both design and installation methods can be standardized.
- All joints are properly designed to industry standards by expert engineers.
- Each item is supplied in the correct quantity for a properly designed joint.
- Accumulation of dead stock is avoided. No waste.
- All materials are kept clean and ready for use.
- Each Unit Splicing Kit is labeled for easy identification.
- Easy to quickly estimate costs for any particular job.

For your convenience, we carry in stock all the materials required to make joints on any size cable and we regularly supply these materials in unit package form.



G&W Splicing Kits include each necessary item of material in the correct grade and proper quantity for making a cable joint of our standard design (or your own design or special type).

G&W SPLICING KIT BULLETINS ARE YOURS ON REQUEST.

- BUL. CJ1 -Straight 2 way-VARNISHED CAMBRIC, LEAD COVERED.
- Single and Multiple Conductor BELTED.

 BUL. CJ2 —Straight 2 way—VARNISHED CAMBRIC, LEAD COVERED.
- Three Conductor SHIELDED.

 BUL. CJ3 —Straight 2 way—PAPER INSULATED, LEAD COVERED.
- Single and Three Conductor BELTED.

 BUL. CJ4 Straight 2 way—PAPER INSULATED, LEAD COVERED.
- Three Conductor SHIELDED.

 BUL. CJ5 —Straight 2 way—RUBBER INSULATED, LEAD COVERED.
- Single and Multiple Conductor.

 BUL. CJ6R—2 way & 3 way Y—RUBBER INSULATED, NEOPRENE JACKETED.

 Single and Three Conductor.
- BUL. CJ7 —Cable Terminating Kits for Single and Three Conductor.
 RUBBER INSULATED, NEOPRENE JACKETED.
- BUL. CJT -2 way & 3 way Y-TELEPHONE & SIGNAL CABLE JOIN'S.

You can order splicing kits without referring to bulletins-

SPECIFY: Quantity; Type—2 way or 3 way Y; Complete cable data including number, size and type of conductors, kind and thickness of insulation and covering, shielded or nonshielded, Operating voltage, grounded or ungrounded neutral. When wanted.

J541



FELECTRIC SPECIALTY COMPANY

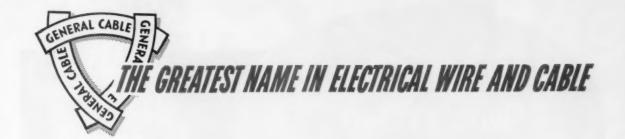
Cable Terminating, Connecting and Sectionalizing Devices

Representatives in principal cities of U.S.A. • In Canada — Powerlite Devices, Ltd., Toronto, Montreal and Vancouver











To wire a plant, or wind a coil

IT PAYS TO BUY IN ONE PLACE!

Actually there is only one source for all of the types of wire and cable you may need...that's General Cable. To meet your every requirement, General Cable manufactures bare, weatherproof and insulated conductors of every variety ...maintains vast stocks...the broadest distribution facilities in the industry...ultra-modern plants coast to coast. Specify "General Cable." Don't settle for less.



GENERAL CABLE CORPORATION 420 Lexington Avenue, New York 17, New York Sales Offices: Atlanta • Buffalo • Cambridge (Mass.) • Chicago • Cleveland • Dallas • Detroit • Greensboro (N. C.) • Houston Indianapolis • Kansas City • Los Angeles • Milwaukee • Minneapolis • New York • Newark (N. J.) • Philadelphia • Pittsburgh • Portland (Ore.) • Rome, N.Y. • Rossmoyne, O. (Cincinnati area) • St. Louis • San Francisco • Seattle • Syracuse • Tulsa • Washington, D. C.







CUT COSTS...SPEED JOBS
WITH GREENLEE
TIMESAVING TOOLS

Greenlee Hydraulic Conduit Bender

Conduit installations go far faster . . . neat, tailor-made jobs result every time with a Greenlee Bender. Many owners report labor savings from 50% to 90% . . . and the cost of many manufactured bends and fittings is eliminated. For, with the Greenlee, one man in but minutes makes smooth, accurate bends in pipe up to 5", rigid and thin-wall conduit, tubing and bus bars. Compact and portable, the Greenlee Hydraulic Bender can be easily and quickly moved for on-the-job bending exactly where and when wanted! Users say it often pays for itself on the very first job.





Hand Benders for Tubing

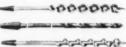
Swiftly produce accurate small-ca'ius bends (up to 180°) in conduit, pipe and tubrug. No flattening or kinks. GREENLEE Hand Benders are especially designed to form neat bends to fit sharp corners, nooks and other close quarters. Eliminates need for many manufactured bends and fittings. Various sizes and models... handy companion tools to GREENLEE Hydraulic Benders for quickly "custom saking" your own complete conduit installations right on the job.



Knockout Punches and Hydraulic Punch Driver

Quick, easy way to make knockout enlargements for 3/8" to 4" conduit. Simply insert GREENLEE Knockout Punch in knockout or small drilled hole, then turn with an ordinary wrench. For an even faster, practically effortless operation, drive Punch with powerful, portable GREENLEE Hydraulic Driver shown below.





Boring Tools For quickly making clean, smooth openings for conduit and wiring. The GREENLEE line includes Electricians' Unispur and Solid-Center Auger Bits, Bell Hangers' Drills, Expansive Bits, and Bit Extensions.



Cable Puller Easy-operating, compact unit for 7,500 pound pull. Fastens directly to conduit for pulling in line with conduit. . . . no loosened hangers. Attachment available for concealed conduit work.

SEE YOUR ELECTRICAL DISTRIBUTOR Get complete information on the above and other Greenlee timesaving tools: Hydraulic Pipe Pushers • Joist Borers • Chisels and Gouges • Radio Chassis Punches • Angle-Screw Drivers • Spiral Screw Drivers • Automatic Push Drills • and many more. Greenlee Tool Co., 1744 Columbia Avenue, Rockford, Illinois.











HUBBELL

Twist-Lock

3 and 4-WIRE ELECTRICAL LOCKING CONNECTORS FIRST
AND
STILL
THE
FINEST

Rug

No. 7311 20 amp.

For Greater Convenience, Safety and Efficiency in the Operation of Motor-driven Tools or Portable Electrical Apparatus.

No. 7313 20 amp.

> Nos. 7311 and 7313 RATED 20 AMP., 250 Volts AC or DC; 10 AMP., 600 Volts AC



10 ampere Twist-Lock 3-wire grounded duplex receptacle available for back or side wiring.



10 ampere Twist-Lock 3-wire single receptacle. Available grounded to metal strap on request.

No. 7582

Back view of unit shown above indicating back wiring holes and sturdy construction. NEVER DISCONNECTS ACCIDENTALLY

When converting from 2-wire to 3 or 4-wire systems ... to increase electrical capacity—for safety—for system modernization—or for grounded protection ... it makes good sense to select a device which is known to have ruggedness, dependability, and long life. Hubbell Twist-Lock is your logical first choice. 3 and 4-wire Twist-Lock sizes are available grounded and not grounded.

All Graybar branches carry a complete stock of Hubbell Twist-Lock, Hubbellock and straight blade wiring devices. Service is as close as your telephone.



Write for Twist-Lock folder which illustrates the complete line.

WIRING



DEVICES

HARVEY HUBBELL, INC.

BRIDGEPORT, CONN.

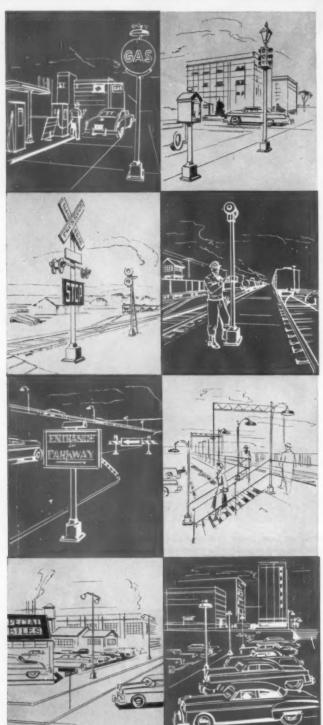
124454

Nez. 7580-G and 7582 Rated 10 AMP., 250 Volts; 15 AMP., 125 Volts





Handle these...and other...outdoor jobs*



*LIGHTING APPLICATIONS—Parking lots, used car lots and gasoline stations
• Railway platforms, stairways, crossing and switching signals • Bridge lighting • Highway blinker lights and lighted signs • Traffic signals • OTHER APPLICATIONS—Police and fire boxes • Railroad yard loudspeakers.

with — A rigid support for cut-to-length pipe.
A junction chamber for splicing and grounding

COMBINED IN

THE NEW HOPE METAL-PIPE BASE

Here's the new, simple, low-cost way to supply custom-made uprights for outdoor lighting and other electrical applications. Start with Hope Metal-Pipe Bases. Use standard conduit or pressure pipe of the length and diameter needed. Cut and thread it to fit the rugged malleable iron base, and to take the lighting fixture. Buy base, pipe and fixture through your wholesaler—assemble them yourself—splice and ground in the junction chamber when you install. And the job is done!

For information on this flexible way of installing lighting (and other jobs) get in touch with your electrical wholesaler—or write us direct.

Hope Metal-Pipe Bases for 2'', $2\frac{1}{2}''$, 3'' and 4'' pipe are available through your electrical wholesaler. Buy or specify by pipe size and catalog number, galvanized or unfinished:

2" - H 42200 3" - H 42300 21/2" - H 42250 4" - H 42400



CAST BOXES BY HOPE

JUNCTION AND PULL BOXES • TERMINAL BOXES EXPLOSION HOUSINGS, CLASS I, GROUPS C & D EXPLOSION HOUSINGS, CLASS II, GROUPS E, F, G HINGED CABINETS • EXPLOSION GUTTERS

Write for complete catalog



HOPE ELECTRICAL PRODUCTS CO. 345 Wilson Avenue, Newark 5, N. J. Mitchell 2-4426











Offers a Complete Line of

... to Make Any Wiring Job Easier! ... to Cut Your Wiring Costs!



IDEAL FISH TAPE, REEL and PULLER

(Patented, No. 1,890,945)



Saves Time and Work -Protects Tape

A three - in - one tool that saves up to 50% in fishing time. Reel gives B1G pulling power that makes long conduit runs easy to handle. SAFER because tape is always under control in the reel or conduit—can't spring loose or kink. Reel protects the hands and eliminates need for special pullers, pliers or bare-hand pulling. Tape is finest flat, tempered spring steel. Five stock sizes and lengths, 50 to 200 feet.

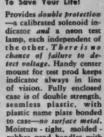
EVERYTHING YOU NEED FOR FISHING

IDEAL furnishes a complete line of fish tapes and accessories, including: flat fish tape, with or without reel; round and nylon covered tape, with or without reel; Coil-Flex (spring type) tape, fish tape leaders and fish tape balls.



The Super-Safe **VOLTAGE TESTER**

You Can't Buy a Safer Voltage Tester To Save Your Life!



plastic name plate bonded to case—no surface metal.

Moisture - tight, molded - rubber prod handles with "No-Slip" safety rings are mounted on 30" neoprene leads. Prod storage in case completely shields sharp tips when prods are not in use. Tests 110 to 550 volts AC—110 to 600 volts DC.



(IDEAL) "E-Z" STRIPPER

Rugged, All-Steel Construction for Fast, Clean, Heavy-Duty Stripping

As easy to use as pliers. Does not score or damage wire. At end of stripping stroke, automatic lock prevents snap-back and crushing of stranded wire. Replaceable blades are of hardened steel. Eight models handle all wire gauges from No. 8 to No. 26; also 300 ohm TV downlead and most non-metallic sheathed cable.





(Patented, No. 2,523,926)

Exclusive "One - Squeeze" action strips wire clean in 2 seconds! Especially suited to



(IDEAL) WIRE LUBE

Makes Wire Pulling Easier and Quicker . . . Protects Insulation



. Protects Insulation
Applied by hand or brush.
Provides a thin film of
lubricant that makes tough
wire pulling jobs far less
work. Dries quickly to a
fine powder that makes it
easier to remove wire from
conduit later if necessary,
or to add additional wires.
Non-corrosive, non-combustible — harmless to
hands. For use on rubher, lead or plastic covered
wire cable. (Cannot be
used on asbestos covered
wire.) In 1-qt. to 5-gal.



DELUXE CABLE RIPPER

Rips Outer Sheath From Non-Metallic Cable Instantly Non-Metallic Cable Instantly Faster because cable is in-serted into cradle of the tool from side. No time lost in threading it into cutters, etc. Depth of cutting blade is ad-justable for different sizes of cable. Blade is replaceable. Handles cable up to ½" O.D. Built to last for years.

Cable Ripper and Wire Cuts cable cleanly and easily. Just squeeze onto cable and pull. For non-metallic, sheathed or lead covered cables with O.D. up to \%". Very inexpensive.

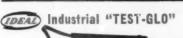


"SAFE-T-GRIP" **FUSE PULLER**

Assures Safe, Positive Grip

Do away with the danger of pulling and replacing carteridge fuses by hand and the bending of clips through improper removal. Formed to fit the fingers—no slipping. Strong, laminated fibre construction. High dielectric properties. Three sizes for practically all fuses.





The Safest, Easiest-to-Use Test Light for Electrical Circuits, Sparkplugs, Motors, Fuses, etc.

Resistors between test-prod and lead reduce voltage reaching leads. Long, thin handles for deep probing have safety rings to prevent accidental contact with prods. Enclosed neon test lamp is at front end of prod handle, in line of vision. Glows on 80 to 600 V. AC or DC. Leads are 24" long.



(IDEAL) CONTINUITY TESTER

Tests Dead Circuits with-out Need for Live Wire Connections

Connections

Enables safer testing of unknown or untested circuits in building and household wiring, communication equipment, control panels, etc. To test for electrical continuity between two points just apply the 4-ft. clip to one point in the circuit and touch the prod-clip to the other. Test lead is detachable.



(IDEAL) ELECTRICIANS TAPES

Complete Line of Top Quality Tapes— Friction, Rubber and Plastic



You need ALL THREE to meet ALL insulating needs! In popular sizes, conveniently packaged. Friction tape also in spe-cial widths and lengths on special order to large





IDEAL INDUSTRIES, Inc. 1041 Park Avenue, Sycamore, Illinois.











LOW BUDGET SCHOOL WITH

HIGH LEVEL LIGHTING

... by LITECONTROL

Built with little more than a shoestring through the efforts of Father Brady, the curate, this Parochial School contains many interesting cost-cutting features. One of the best is LITECONTROL'S attractive lighting fixture No. 4624.

Extremely efficient (86%), it combines low initial cost with unusually

easy maintenance.

Curved metal side panels are illuminated by reflected light from ceiling and walls, thus showing a luminous appearance and practically eliminating contrast between fixtures and ceiling. Smooth curved sides and lamps are cleaned from above with just one pass of a tank type vacuum cleaner.

Baffles are hinged from either side and may be installed or removed without use of tools.

FIXTURES: Litecontrol No. 4624 mounted on 8" stems. Cutoff 38° crosswise, 26° lengthwise. Standard cool

white 40-watt lamps

INTENSITY: At desktop level, 30 footcandles in service.

WATTS PER SQUARE FOOT: 1.7.

Another example of the "More Light and Looks for Your Money" you get with every LITECONTROL Fixture. It will pay you to know the complete line. See your local LITECONTROL man.



LITECONTROL Fixtures

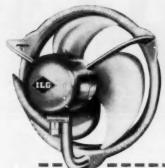
LITECONTROL CORPORATION
36 PLEASANT STREET, WATERTOWN 72, MASSACHUSETTS

DESIGNERS. ENGINEERS AND MANUFACTURERS OF PLUGRESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS









TYPE "P" —high speed, maximum air volume within minimum dimensions. For use on systems up to .6" static pressure. Self-cooled motor. 4 sizes.

maintain an

"Air of Efficiency

TYPE"W"—for large diameter wheels, 60" to 72" sizes. Dynamically balanced wheel. Rigid, sturdy frame. Self-cooled motor.





PROPELLER FANS

• faster air change • minimum maintenance

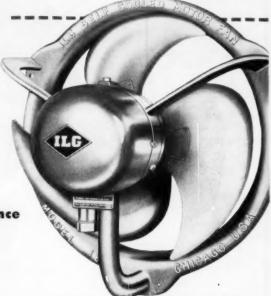
lower power costs

Efficient operation calls for efficient ventilation... ILG ventilation! Equipped with self-cooled motors, Ilg Propeller Fans assure you longer, trouble-free, dependable performance. Rated and certified under standard testing codes, you can count on Ilg Fans to move more air. Dynamically balanced fan wheel, direct-connected to motor, assures smooth, quiet, free-running operation. And Ilg's famous "one-name-plate" guarantee covers both fan and Ilg-built motor as a unit.

You can choose an Ilg Fan from a complete range of sizes...6" to 72". And you can expect fast delivery, too, because adequate stocks of Ilg Fans are maintained everywhere. You'll find experienced ventilating experts in all principal cities... ready and able to solve your air-moving problems. See your dealer, or write...

ILG ELECTRIC VENTILATING CO.

2850 N. Pulaski Road, Chicago 41, Iilinois



TYPE"Q"—powerful, quiet, efficient . . . plus long life, minimum maintenance. Self-cooled motor. 6" to 48" diameter wheels.



TYPE "I"—has TYPE "Q" wheel and ball bearing, explosion-proof motor. Non-ferrous frame. 16 capacities.

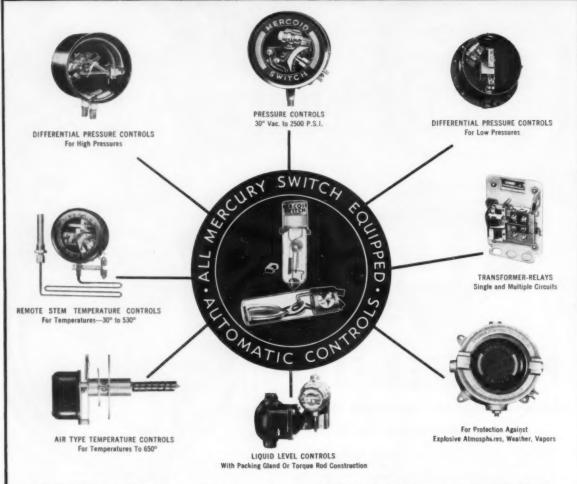






MERCOID CONTROLS

FOR INDOOR, OUTDOOR OR EXPLOSIVE ATMOSPHERES



APPLICATION: Mercoid Controls are adaptable to a wide range of applications involving the control of pressure, temperature, liquid level or mechanical movement.

ELECTRICAL CONTACT: Mercoid Controls incorporate sealed mercury switches which are impervious to dust, dirt and corrosion. These switches can give a million operations without deterioration.

CIRCUIT ARRANGEMENTS: There are any number of

special circuits available to meet your particular problem.

OPERATING RANGES—SENSITIVITY: Mercoid Controls are available in many ranges with the sensitivity your application requires.

CONSTRUCTION: Standard type instruments are furnished with steel case. Special cases and housings are available for protection against weather, excess vapors, splashing or explosive atmospheres.

If you have a control or mercury switch problem send details to our engineering department.

Write for Catalog No. 7008

THE MERCOID CORPORATION, 4201 BELMONT AVE., CHICAGO 41, ILLINOIS

NEW YORK, 205 EAST 42nd STREET

PHILADELPHIA, 3137 N. BROAD STREET







CONTRACTORS

DEPEND UPON THE CONSISTENT QUALITY OF



MULTI

ELECTRIC MFG. INC.
4223-43 WEST LAKE STREET . CHICAGO 24

Lighting Equipment and Electrical Specialties

for QUALITY
SHOWER ROOM FIXTURES



for QUALITY with ECONOMY
MOISTUREPROOF FIXTURES



for QUALITY

GYMNASIUM FIXTURES



CAST ALUMINUM GUARD



for QUALITY
EXIT FIXTURES



for QUALITY

CARTRIDGE FUSE CUTOUTS



SPECIAL ATTENTION GIVEN TO PRODUCTION ACCOUNT REQUIREMENTS.

30 TO 600 AMPS
IN
250 VOLTS
600 VOLTS
MAIN LINE
AND BRANCH



for QUALITY

ILE-LITES



for QUALITY
PORCELAIN ENAMELED REFLECTORS



SPECIAL BULLETIN

AVAILABLE UPON REQUEST

CHECK AND MAIL

LIGHTING EQUIPMENT FOR

☐ LIGHTING EQUIPMENT FOR GYMNASIUMS & SWIMMING POOL

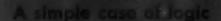
Address

CityZone









Sherardizing is Galvanizing of its best



THESE **FEATURES**

is Galvanized Conduit at its best



2. THREAD PROTECTION . . . coupling threads and surfaces are fully zinc protected . . . Sherarduct coupling permits butting of conduit within the coupling.

It's the Sherardizing process that fortifies Sherarduct . . . a dry galvanizing process that actually alloys corrosion-resistant zinc to the steel wall. This is galvanizing at its best!

Sherardizing provides 100 percent uniform zinc protection over all surfaces including the hills and valleys of every thread. This is Sherarduct . . . galvanized conduit at its best!

Finally, NE's baked-on Shera-enamel seals the zinc against acids and other corrosive elements. Sherarduct Conduit provides lifetime protection for all wiring.

Insist on National Electric Sherarduct



3. Works easily . . . Fishes easily . Bends without flaking.

EVERYTHING IN WIRING POINTS

National Electric Products

PITTSBURGH, PA.

3 PLANTS . 8 WAREHOUSES . 34 SALES OFFICES







Specify EVEREADY for long life, low operating cost, dependability



"EVEREADY"
RR AND INDUSTRIAL
DRY CELL No. 6

Specially designed to meet a wide range of service conditions, from very heavy to very light drains.



"EVEREADY" No. 409 LANTERN BATTERY

Gives dependability and long life. Designed to fit many popular types of hand lanterns.



"EVEREADY" "COLUMBIA" "GRAY LABEL" TELEPHONE CELL No. 6

Extraordinarily long life . . . the most widely-used telephone dry cell in the world!



"EVEREADY" No. 1050 INDUSTRIAL FLASHLIGHT BATTERY

Delivers twice the usable white light of any previous "Eveready" flashlight battery. Specially designed for heavy-duty use.



"EVEREADY" No. 950 BATTERY

Gives you the ideal balance of long shelf-life and service-life for all applications, except extreme heavy-duty uses where the "Eveready" No. 1050 battery is recommended.



"EVEREADY" "IGNITOR" DRY CELL No. 6

Outstanding recuperative power makes this battery the finest obtainable for ignition, radio, bells, buzzers, electric games, toys, lanterns, etc.



"EVEREADY" No. 1251 INDUSTRIAL FLASHLIGHT

Ruggedly-built case is resistant to shock, water, oils, greases, gasoline, alcohol and acids. Switch is easily removed and replaced by hand. Ring hanger in bottom cap.



"EVEREADY" No. 7251P FLASHLIGHT

Unbreakable, polyethylene lensguard glows with high-visibility red light for added safety. Cushions shocks, protects head.



"EVEREADY" No. 1259 INDUSTRIAL FLASHLIGHT (APPROVED SAFETY TYPE)

Approved by the U. S. Bureau of Mines and listed by Underwriters Laboratories, Inc. for use in explosive, gaseous atmospheres. Ring hanger and spare bulb in bottom cap.



"EVEREADY" No. 8251 FLASHLIGHT

Automatic spotlight with removable bottom cap and ring hanger. Finished in durable chrome plate.

The terms "Eveready", "Ignitor", "Columbia", "Gray Label", "Nine Lives" and the Cat Symbol are registered trade-marks of Union Carbide and Carbon Corporation

NATIONAL CARBON COMPANY

A Division of Union Carbide and Carbon Corporation • 30 East 42nd Street, New York 17, N.Y.

District Sales Offices: Atlanta, Chicago, Dallas, Kansas City, New York, Pittsburgh, San Francisco IN CANADA: Union Carbide Canada Limited, Toronto









UALBO



Of course the most convincing proof of Orangeburg's enduring quality is its 60year record of service to Contractors, Public Utilities and Municipalities.

Quality stands out in every feature. Orangeburg Fibre Conduit is lightweight yet strong, tough and resilient. Its impermeable walls and tight joints keep out corrosive ground waters. Its smooth bore and low coefficient of friction protect cable sheaths from abrasion. Orangeburg material resists acids, alkalies, salt, grease and oil.



ORANGEBURG STANDARD is installed with concrete encasement. Preferred for banks of three or more ducts.

For these and many other advantages Orangeburg Fibre Conduit provides complete protection for the expensive underground cables. With no interruption of the power the communications continue to flow year after year.

SAVES MONEY, TOO!

Design engineers specify Orangeburg Fibre Conduit because it saves by prolonging cable life . . . saves by faster handling and laying, saves by the use of Orangeburg's standard fittings which cut costs and simplify installations. Send to Dept.EC-45 for more facts.



ORANGEBURG NOCRETE is installed without concrete encasement. Extra heavy wall for direct burial.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, New York

West Coast Plant — Newark, California

STANDARD

INSTALLED WITH CONCRETE

NOCRETE INSTALLED WITHOUT CONCRETE





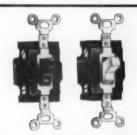


JUST FOUR EXAMPLES OF P&S ENGINEERING AND MANUFACTURING SKILL

STANDARDIZE ON P



for... Dependable, Long Life Operation-Quick, Easy Wiring



Pas SUPER A. C. SWITCHES

Maximum Service—Quiet Operation—Extra Long Life. Rated 15 and 20 Amperes, 120 Volts A.C., 277 Volts A.C. For use at full rated capacity on fluorescent and incandescent loads—up to 277 Volts at 80% of current rating of switch on motor loads.



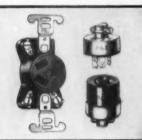
P&S T-Slot Duplex Outlets

The Specification Type Duplex Outlet with completely insulated back. Large binding screws spaced for easy wiring — Long-life, phosphor bronze contacts—Plate screw hole tapped in strap, no rivet to twist or turn—Easy-find slots.



P&S Turnlok, Line

Just turn the cap and it's locked, securely and safely. Sturdily constructed—Designed for easy wiring—Ampere rating plainly visible on modern face design. Connectors, receptacles and caps available in 10 and 20 Amperes—2, 3 and 4-wire types.



P&S POLARIZED DEVICES

Built sturdier with extra thick bodies and extra heavy metal parts—to withstand rough usage over a long period of time. Designed for wiring ease. A complete line of 10 and 20 Ampere, 2, 3 and 4-wire connectors, receptacles and caps.

Other P&S Products: The original P&S Despard Line[®]...P&S Surfex[®] Surface Wiring Devices...UNILINE[®] Wall Plates ...Complete lines of Switches, Outlets and Lampholders.

Send for P&S Catalog No. 49 for complete information . . . and order by P&S catalog number.

Department M

PASS & SEYMOUR, INC. • SYRACUSE 9, NEW YORK

Offices: 71 Murray St., New York 7, N. Y. 1229 W. Washington Blvd., Chicago 7, Ill.







boxes are big business at

junction box manufacturing facilities are located in a new 35,000 square foot plant. Here, in a modern building, are men, equipment and space to fabricate a complete line of surface and flush-mounting junction boxes for every application and requirement. A large stock is maintained at all times for speedy delivery. Your O. Z. distributor is now in a better position than ever to fill your needs.



Modern equipment for fabricating junction boxes in this O. Z. box plant means greater efficiency for us... better service for you.



Greatly increased stock assures a constant supply of standard junction boxes and speedy processing of your orders.



ELECTRICAL MANUFACTURING CO., INC.

262 BOND ST. . BROOKLYN 17, N. Y.

CAST IRON BOXES . SOLDERLESS CONNECTORS
CABLE TERMINATORS . GROUNDING DEVICES
POWER CONNECTORS . CONDUIT FITTINGS









No husky bruisers are needed on your crew when you work with Pittsburgh Permaflector Lighting Units. All parts fit together easily, quickly, compactly. Fluorescent Units are wired complete, ready to install; knockouts for lead wires and mounting are clearly marked; inline installations can be aligned perfectly. Incandescent Units are simple to assemble into desired arrangements and combinations for every lighting need. Standard Units are available to fit into fluorescent troffer and luminaire assemblies.

Next time—whistle while you work. Use time and labor-saving Pittsburgh Permaflector Lighting Equipment.



Pittsburgh Reflector Company

404 OLIVER BUILDING · PITTSBURGH 22, PENNSYLVANIA

Manufacturers of Fluorescent and Incandescent Lighting Equipment

The Garfield

A&B 13000 Series



4 & 8 Ft. 2-LAMP LUMINAIRES with Low, Low Lines!

The luminaire with the "built-in" look for end-to-end or individual mounting 1 35° x 35° shielding, polystyrene side panels, hinged louver bottom! For details write for Bulletin N.

DISTRIBUTED BY ELECTRICAL WHOLESALERS EVERYWHERE

PERMAPLECTOR LIGHTING ENGINEERS IN ALL PRINCIPAL CITIES









Light the Way to Better Sales



Wide Selection of Pylon-Lites with or without air and water Servicing

LOWER INSTALLATION COSTS . . . Simple, uncomplicated design for ease of mounting and ease of servicing.

SAFETY . . . Subjecting Revere Units to the severest tests fulfilling Under-writer's Laboratories requirements.

Consult us today . . . a local representative will gladly acquaint you with the entire Revere Line.

REVERE ELECTRIC MANUFACTURING COMPANY 6017 BROADWAY . CHICAGO 40, ILLINOIS

Available in Canada through Curtis Lighting, Ltd. . Leaside, Toronto, Ontario

Hinged Poles With Air and Water Service

THE ONLY COMPLETE LINE OF FLOODLIGHTS AND POLES for Service Stations . Sports Areas . Storefronts . Outdoor Theaters . Marine and Industrial Lighting









CAN TOP THE ORIGINAL!

TYPE NMC TYPE UF UNDERGROUND FEEDER



First U/L listed all-thermoplastic non-metallic sheathed better-barn cable specifically approved for wet and corrosive conditions as in dairy barns and chicken houses.

First U/L listed Type NMC for moist, damp, or corrosive locations, in outside or inside walls of masonry block, tile or plaster.

First U/L listed Type UF for direct earth burial underground feeder or branch circuit cable.

PLASTIC WIRE & CABLE CORPORATION

JEWETT CITY, CONN







SYMBOL OF OUTSTANDING QUALITY



Many electrical equipment items today look quite similar, have standardized ratings and specifications . . . but there is one important variable of value — OUALITY!

More and more, engineers, architects and others concerned with specifying electrical equipment, write "R & S Quality" into specifications. Increased numbers of contractors, electricians, distributors and others who sell R & S quality at the point of sale, see convincing evidence of its effect on customer satis-

faction and repeat business. Industry, as the user of over 5000 R & S electrical equipment items, has discovered that this quality means complete electrical dependability and long service life.

All these advantages are symbolized by this well-known Russell and Stoll registered trade-mark. It is emblematic of over 50 years of specialized experience, sound engineering design, finest materials and precision manufacture.

REPRESENTATIVES IN PRINCIPAL CITIES

Atlanta * Boston • Chicago • Cleveland • Dallas • Dayton • Denver • Detroit • Greenwich • Indianapolis • Los Angeles • Louisville Minneapolis • Newark • Oklahoma City • Omaha • Philadelphia • Pittsburgh • St. Louis • San Francisco • Seattle • Tulsa • Wichita

RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N. Y. D-13

RUSSELL & STOLL PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902







WHAT DO YOU NEED INA TIME SWITCH?

Synchronous Carryover?

When equipped with the carryover, Sangamo Time Switches keep right on running-even when the electric power fails. An electrically wound main spring automatically takes over until power is restored. It provides up to 10 hours of reserve operation.

Short OFF Periods?

If your application needs a minimum OFF period as low as 30 minutes Sangamo can furnish a switch with reversed time limits, so that the minimum OFF period is considerably shorter than the minimum ON period.

Omitting Devices?

Your Sangamo time switch can omit one or more days of repetitive operation from a weekly schedule for applications where factories are closed on Sunday, on week-ends, or on any other days of the week.

Advance Time Control? If you need an earlier than normal start on il you need an earlier man normal start on some special operation, Sangamo can furnish some special operation, sangamo can turman an auxiliary control to provide an early ON operation on any given day or days of the

Sun Time Operation?

The famous Sangamo Astronomic Dial functions auto...atically to control daily time switch operation in accordance with the time of sunset and sunrise, compensating daily for the changing seasons. No periodic manual resetting

Sangamo has the answer..!

If you need time switches for the simplest single ON and OFF operation, or for complex weekly schedules. Sangamo can fit your exact needs from the complete line with special control features.

All Sangamo Heavy-Duty Time Switches are built to provide an extra margin of dependability, and all have these features:

LOW-SPEED MOTOR

The exclusive Sangamo built low-speed low loss motor (450 R.P.M.) means less bearing wear, and, consequently more years of service.

LIFETIME LUBRICATION

A special silicone grease assures perfect operation in a temperature range from 50 degree F. below zero to 200 degree F. above. No special motor coils are required even in the coldest climates.

OVERSIZE SILVER CONTACTS

The pure silver contacts are very conservatively rated and minimize troublesome arcing by combining a slow break action with a small gap.

MACHINE-CUT GEARS

The heavy gears are precision made. They transmit the power to the dial smoothly and possess strength in excess of any service requirements.

Get the full story . . . Write for Catalog No. 1010-A



ELECTRIC COMPANY SPRINGFIELD, ILLINOIS



ST52-8







ALL-PURPOSE INCANDESCENT DOWNLIGHTS

Designed to

PROVIDE MORE LIGHT

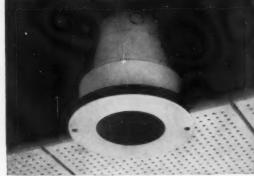
AT LOWER OVERALL FIXTURE COST

WITH HIGHER MAINTAINED EFFICIENCY



Silver-spot

Silver-dot



with ...

BETTER GLARE CONTROL
EASIER RELAMPING

THAN ALL OTHER
RECESSED LIGHTING DEVICES

HERE ARE THE FACTS

MORE LIGHT

The Silver-spot and Silver-dot units using 100W—A-21 silvered bowl lamps produce higher lighting levels than all other types of recessed equipment using equivalent wattage. The Silver-spot unit develops nearly twice the candlepower of the 150W or projector lamp.

LOWER COST

Considering future lamp replacement and energy cost, the savings afforded by using Silver-spot and Silver-dot units will often pay for the equipment itself within 5000 hours of use of the unit.

EASIEST RELAMPING

Silver-spot and Silver-dot units use the compact 100W—A-21 silvered bowl lamp. They are designed so that lamps may be replaced either by hand or by using pole type vacuum operated lamp changers, without removing any fixture parts. No louvers, shields, glass or lenses to handle—no parts to get lost.

HIGHER MAINTAINED EFFICIENCY

The silvered bowl lamp with a sealed silver reflector is the heart of the Silver-spot and Silver-dot optical system. Each time a new lamp is installed the unit is restored to initial efficiency.

BETTER BRIGHTNESS CONTROL

In the Silver-spot and Silver-dot units the lamp filament is completely shielded by the silver process. The reflector is shielded by the fixture design to at least 45°. This means that these units can be used effectively in any area without glare or discomfort.



SILVER-DOT DISTRIBUTION

7ONE

Silver-spot units may be recessed or surface mounted. Both Silver-spot and Silver-dot recessed units are furnished complete with plaster rings.

Each unit sold complete with two 100W—A-21 silvered bowl lamps.

SKYLIKE LIGHTING, INC.

RKO BLDG., RADIO CITY NEW YORK 20, N. Y.







After the sun goes down



Tight construction schedules often mean working after the sun goes down. Without dependable portable lighting, shovel work and other construction jobs can be dangerous. If electrical cords fail, work and profits stop. That's why your lighting equipment should be wired with Simplex-TIREX Cords.

TIREX is the toughest, most abrasion-resistant cord made. It resists the crushing action of truck tires. It can take the beating of sharp chunks of rock dropping on it. It resists oil and flame. It is extremely flexible.

TIREX is the only portable cord made with Selenium Neoprene Armor. It is unequaled for balanced resistance to water, acids, and sunlight. Because of these qualities, it is exceptionally long-lived. All TIREX Cords are cured in lead.

Whether the sun goes up or down, you can do no better than to specify TIREX for all your electrically-operated portable equipment. For any job, no matter how tough, requiring the use of portable cords or cables, be sure that

Sumpler WIRES & CABLES

CORDS AND CABLES are made only by the

SIMPLEX WIRE & CABLE CO., 79 Sidney St., Cambridge 39, Mass.









September 2 so, you think you're saving your customer's money?

Far too often people figure lighting fixtures are all alike and buy and sell by price tag alone. You may save your customers a dollar or two on the price of each unit, but are you really saving their money?

Today's carefully engineered lighting installations are planned with units that are designed to deliver more light at less cost. Fewer units are required to secure the same results. So, installation costs are less. And most important, power and maintenance costs are less during the whole life of the installation.

Take the Smithcraft DIRECTOR, for example. A recent comparison test by one of the nation's leading electric utilities clearly demonstrates that the Director produces more light and better light per dollar spent than ordinary fixtures.

Installed in literally thousands of banks, stores, schools and similar locations across the United States, the Smitheraft Director is in a class by itself for appearance, for quality of lighting and for soundness of investment. Be sure you have the complete story on the Smitheraft DIRECTOR when planning lighting installations. Ask us to send you our Smitheraft Director folder.

Photograph shows Director Installation in the offices of the Credit Representative of the First National Bank of Boston, Empire State Building, New York.









CONDUIT

protects the wiring systems in each of these 10000000 modern

Cargo Operations Building, New York International Airport South Side Generating Station, Jacksonville, Fla. buildings



000







here's why:

Spang Conduit is the combination of tcp-grade steel and quality-controlled manufacturing which gives you conduit to fit any wiring needs.

Evidence of the wide demand for Spang Conduit can be found in the many types of buildings for which Spang exclusively has been specified. Whether it's an airport, a manufacturing plant, a power plant, an office building, a home . . . no matter what the type of building . . . architects and contractors find that Spang offers the conduit best suited for their needs.

Spang is easier to cut, thread, bend and weld, saving valuable time and money on conduit installation. Take your choice of any of the "big four" in a full range of sizes. Spang offers you Cenlaco, Central Black, Central White, and EMT with the SPANGLEAM Finish.



TWO GATEWAY CENTER, PITTSBURGH, PA District Offices and Sales Representatives in Principal Cities







EASIER TO INSTALL AND MAINTAIN!



mount 1 device instead of 2

extra-wide gutters

all components accessible from front

plenty of knockouts

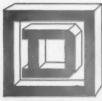
SQUARE D COMBINATION STARTERS

(Switch or Circuit Breaker Types)

Save space and time. Mount and wire one device instead of two...

neater, more attractive installations.

COMBINATION STARTERS and other Square D Products are distributed by GRAYBAR



SQUARE D COMPANY









the Emblem of Quality since 1875

Electrical Signals and Systems



UNIPACT SIGNALS. Need one—or a series of bells, chimes, buzzers or horns? You can have your choice, because these various types of signals are interchangeable; no new wiring is needed. UNI-PACT Signals meet noise level requirements with tailormade results.



FARADAY FIRE ALARM SYSTEMS. FARADAY Fire Alarms provide extra protection. A wide variety of systems to meet all fire warning requirements. Models available for surface or semi-flush installations. FARADAY is known for dependability throughout the industry.



FARADAY CLOCKS. Can be furnished for remote control by master units, or for direct-operating installations. FARADAY models, with exclusive plug-in feature, are supplied for surface, double-dial or flush mounting, in 10, 12 and 15 inch sizes. Easy-to-read dials are white, with bold Arabic numerals.



FARADAY PHONACALL STATION CONTROL UNIT. Features complete volume control, for both talking and listening. Push-button control. Equipped with both audible and visual signal. Compact design. Uses minimum desk space. Distinctive, durable, hammer-tone gray finish.

CONSULT YOUR NEAREST GRAYBAR BRANCH FOR COMPLETE DETAILS.

HOLTZER-CABOT FARADAY STANLEY & PATTERSON

ARABAT OMMEN & MILENOO

SPERTI FARADAY INC

BELLS . BUZZERS . HORNS . CHIMES . VISUAL AND AUDIBLE PAGING DEVICES AND SYSTEMS







NEW STEBER UNITS

For R-52, R-57 and Mercury Vapor Reflector Floodlamps



Gymlite-Flush Mounting

The new STEBER CAST ALUMINUM HB-1 unit is specially recommended for installation where atmospheric conditions would damage ferrous metal fixtures and wiring equipment.

The unit is coated with silicone type high temperature baked enamel for easy cleaning and corrosion-resistance. Silicone gasket prevents moisture and dirt from penetrating into the glazed porcelain socket and absorbs vibrations which might cause premature filament failure. The center contact is spring loaded to assure good electrical contact. Listed by Underwriters' Labs., Inc. Write for Bulletin 1066.

HIGH BAY LIGHTING UNIT HB-1



To prevent lamp breakage due to falling moisture from pipes or ceiling, the Steber accessory shield HB-2 is available. This spun aluminum shield has the exclusive Steber Anadal finish for longer life and easier maintenance.



NEW GYMNASIUM FIXTURES

Steber units use R-40, R-52 and R-57 lamps which contain their own reflectors. Light is maintained at a high level because there is no reflector to accumulate dirt and require frequent cleaning. When lamps are replaced, brand new reflectors are installed automatically and full light output maintained.

Each Steber unit is equipped with sturdy aluminum hinged guard with spring loaded rubber roller snap-in latch. All units are easy to install and provide modern lighting at low cost. Bulletin 137-53 gives you full details.



Gymlite-Pendant Mounting

Gymlite-Surface Mounting

SPORTS AND INDUSTRIAL FLOODLIGHTS

Steber Floodlights are available in open and enclosed types for 100 to 1500 watt lamps. New Steber features make mounting faster and maintenance easier. Series 4000 for 750 to 1500

Series 4000 for 750 to 1500 watt lamps is ideal for industrial, commercial and sports lighting. Equipped with built-on wrench, repositioning stop, degree marking scale, thermal shock and impact resistant len

thermal shock and impact resistant lens, and many other features found only on higher priced equipment. Listed by Underwriters' Labs., Inc. Bulletin 127-53 gives you light distribution curves and typical lighting layouts.

FOR PAR-38 and R-40 REFLECTOR FLOODS

REFLECTOR FLOODS AND SPOTLIGHTS

All-aluminum, weatherproof, factory wired, universal aiming Steberlites can be mounted on

poles, walls, outlet boxes or to conduit. They are quickly and easily installed and the exact light desired is available by using them singly or in multi-lamp clusters. The flexibility of lites and complete range of fittings make them

Steberlites and complete range of fittings make them ideal for solving almost every lighting problem economically. Listed by Underwriters' Labs., Inc. Write for Bulletin 120-53 giving complete data on all models and mounting brackets.

UNIVERSAL AIMING UTILITES

For PAR-38 and R-40 Sealed Beam Lamps



Utilites are handy, low cost lighting units for every indoor or outdoor service. Steel, chrome plated or all-aluminum types for permanent or temporary mountings. Each fully wired with leads or cord and plug. Color equipment available. Over 4 million Utilites in use! Listed by Underwriters' Labs., Inc. Write for Bulletin 121-53.





STEBER MANUFACTURING CO.
Dept. 98, BROADVIEW (Maywood P. O.), ILLINOIS







MAY, 1904 1 2 3 4 5 6 7 1 2 3 4 5 6 7 1 1 2 3 14 19 20 21 15 16 17 18 19 20 21 15 16 2 24 25 26 27 28 22 23 24 25 26 27 28 29 30 31

50 Years

2 3 4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22
25 26 27 28 29

May 11, 1954

Rounds Out Fifty Years of Producing

Electrical Boxes and Conduit Fittings

Do Better Jobs Quicker

Starting with the manufacture of limited lines of locknuts, brass bushings and cast iron floor boxes in 800 square feet in a building on Pittsburgh's famous "Point," Steel City has developed lines of electrical boxes and conduit fittings now taxing manufacturing facilities occupying more than 148,000 square feet of space in Pittsburgh's North Side. Facilities for production of Steel City-Kindorf Conduit Hangers and Supports are steadily requiring more space than is provided in Oakland, California, making necessary enlarging the Pittsburgh plant.

This growth has been due to these important facts—

(1) A thorough knowledge of the requirements of the items manufactured. (2) Designing such items for ease and timesaving installation. (3) The use of the best available material for their purpose. (4) Rigid inspection along production lines and before shipping to assure against loss of time caused by defective items reaching the job.



Better Jobs Quicker are assured when you specify or use the products of—



Pittsburgh's famous "Point" where the Allegheny and the Monongahela merge to form the Ohio River. This was the site of the building in which Steel City started business fifty years ago. It and many other buildings were razed for development of Pittsburgh's "Gateway to the West."



STEEL CITY ELECTRIC CO.

PITTSBURGH 33 PENNSYLVANIA

CONDUIT FITTINGS

KINDORF DEVICES FOR INSTALLING CONDUIT









REPUBLIC

ELECTRICAL METALLIC TUBING

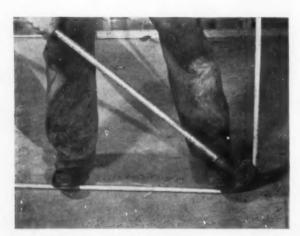


Only Republic Electrical Metallic Tubing is "Inch-Marked®" in the popular sizes. You measure the distance, not the tubing. Cuts easily with a 32-tooth hacksaw blade.

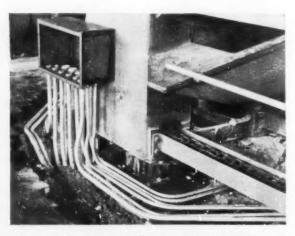


"Inside Knurling" in the popular sizes (½", ¾" and 1") of Republic E.M.T. makes wire-pulling up to 30 per cent easier. This is an exclusive feature found only in Republic Electrical Metallic Tubing.

ELECT RUNITE:



Smooth accurate bends and offsets are easy to make, right where they're needed, using the handy reference marks on the Republic Calibrated Bender. Easy-to-follow instructions are included in the Bending System.



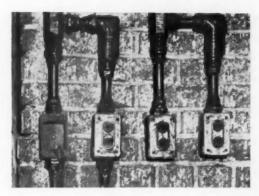
Busy maintenance men like Republic E.M.T. because there are fewer tools to lug around the plant. No threads to cut, because Republic E.M.T. is quickly joined, using Underwriters' Laboratories approved couplings and connectors.







FEATURES



For protection of electrical raceways, where corrosive conditions are extra tough, Republic "Dekoron", the Plastic Coated E.M.T. is the answer. Moisture-tight joints are easily made using threadless connectors and couplings. Joints are sealed with vinyl or plastic tape. This material also available in Rigid Steel Conduit.



Republic E.M.T. in 1¼" size is easy to bend with the Republic Bender. Weighs only 18 pounds, can be carried right to the job by one man. Electrician can use it to make saddles, back-to-back bends and offsets.

make maintenance and modernization

easier

That's why electricians like them. Their work is easier. They have fewer tools to carry around, and the ones they use are light.

Republic E.M.T. was designed to make work easy. The features of Republic, "The Inch-Marked" raceway, plus the Republic Calibrated Bender, add up to a better job in less time. Whether it's modernization, connecting machinery in new locations, or installing new electrical raceways, you can do the job faster with these Republic products.

Contractors have been using Republic "Inch-Marked" E.M.T. for years. Why not make your job easier? Next job, be sure you get Republic ELECTRUNITE E.M.T. and the Republic Calibrated Bender. Ask your electrical supplier.

REPUBLIC STEEL CORPORATION

Steel and Tubes Division
212 East 131st Street, Cleveland 8, Ohio
GENERAL OFFICES
CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, New York

REPUBLIC

REPUBLIC

STEEL

THE CHARGE of Quality







TILDEN

DRILLS MORE CONCRETE HOLES AT LESS COST!

ROTARY KONKRETE KORE DRILLS 5/32" THRU 12"

THE ONLY COMPLETE LINE OF MASONRY DRILLING EQUIPMENT IN THE WORLD!

ROTARY DRILLS * HAMMER BITS * WATER FEED ATTACHMENTS * SPECIAL TILE AND ROCK DRILLS - 5/32" TO 12" DIA. * EXTENSION SHANKS * MORSE TAPERS

Now you can drill straight, clean, low-cost holes even through steel reinforced concrete - FASTER and QUIETER with Tilden Rotary Konkrete Kore Drills. Patented core slot expells cuttings, prevents packing. More cutters-of special sintered tungsten carbide - increase drill efficiency and life. Up to 1,000 inches without resharpening. Use with any electric or air drill. Interchangeable shanks from 5/8" up, for any depth hole. Write today for FREE illustrated catalog and drilling chart.



STARTING CENTERS - F R E E RESHARPENING AND REPAIR SERVICE CONTINUED

TILDEN

TOOL MANUFACTURING COMPANY

209 Los Molinos. San Clemente, California Chicago 26, Illinois







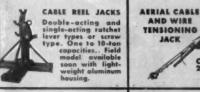




SOLID AND CORE HAMMER BITS

1/4" THRU 11/4"





MANHOLE SHEAVE

Handles up to 3-inches diameter cable or any size winch line. JUNIOR POLE JACK NO. 325

Here's the first time and labor saving improvement in pole jacking in 25 years! New aluminum housing on The Simplex heavy-duty Pole Jack eliminates 35 pounds of weight, without sacrificing a pound of lifting capacity. You can pull or straighten poles, pull butts or move loaded poles without interruption to service—and without digging. Only 60 pounds in weight, it's easy to move from job to job; saves time and work.

This new Simplex No. A-1538 Aluminum Pole Jack has the better-performance and long-lasting construction features that made its predecessor—the famous Simplex No. 329 with malleable housing—the standard Pole Jack of the Bell Systems. The husky "I" beam base gives a firm foundation; jack pivots on the base when pawl is disengaged. The A-1538 has 15-ton capacity and 22-inch lift. Comes completly equipped with steel chain and lever bar.

Get full information now from your Graybar Branch, or write for Catalog No. 50

Simplex

Jacks

TEMPLETON, KENLY & COMPANY

2551 Gardner Road, Broadview, Illinois









for Liquid-Tight Flexible Metal Conduit ... A cinch to install. No need to disassemble these new T & B Connectors. Blue plastic gripping ring gives visual assurance of a tight, leakproof connection ... seals out all maisture, oil, corrosive fluids. Straight connectors, 45° and 90° elbows available for 36" to 2" liquid-tight flexible metal conduit.

for Standard Rigid Conduit..... Mode or shafterproof cellulose acetate butyrate, new T & B Insulating Bushings are the laughest available. Meet NEC requirements for protecting cable sheath or wire Insulation against damage from burred or unevenity cut conduit. Bright blue for easy identification, Sizes from V_2 to 6".



for Service Entrance Cable ..., Color-coded Neoprene bushings and push-out paper discs give atglance size identification on new T & B Watertight of the state of the state of the state of the state of the water, oil, sun, or chemicals. Hex-gland and twoscrew types available ... each size accommodates a wide range of cable diameters.

for Mineral-insulated Gable... Ground and ferminate M. I. cable with these new T & B connectors. Neoprene bushings seal out all moisture. Washer-type brass ring assures a grounding path from the raceway to the fitting's metallic body. Only eight connectors fit all M. I. cable diameters from 309 to 730 inches.



for ShieMed or Coaxial Wire and Calle... Color-coded, compression-type T & B Grounding Sheath Connectors assure positive contact between braids and ground lead — without soldering! Color-coding gives at-a-glance size identification... Installing tool, color-coded to match, assures proper compression for each fitting. For .058" to .297" conductors.





FITTINGS FOR BETTER WIRING



For engineering data, just write to The Thomas & Betts Co. at the address below.

LOOK FOR THIS SIGN -

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is scid only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs.

THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street * Elizabeth 1, New Jersey Thomas & Betts Ltd., Montreal, P.Q., Canada MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898









FRIENDSHIP

HONESTY

LOYALTY

EXTRAORDINARY SERVICE

Those are our roots. Those are the reasons why we grew.

TRIANGLE CONDUIT & CABLE CO., INC.

New Brunswick, New Jersey

Manufacturers of arteries for electricity, liquids and gases

WIRE . CABLE . CONDUIT . PLASTIC PIPE . BRASS AND COPPER TUBE

PLANTS: NEW BRUNSWICK, NEW JERSEY

WIRE AND CABLE PLANT • ROD MILL • BRASS AND COPPER TUBE MILL PLASTIC PIPE PLANT















when you must CUT

COSTS

Thors POWER TOOLS ARE THE ANSWER!



WRENCHES



SAWS



HAMMERS



For quick and drastic cuts in operating expenses, equip your men with POWER TOOLS. Specify THOR for the quality that pays double dividends in extra long troublefree service. Stocked by your supply distributor. Thor Power Tool Company, Aurora, Ill.



INVEST IN QUALITY TOOLS



TOOLS



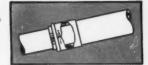




PROVE TOMIC MOST VERSATILE THINWALL COUPLING OF THEM ALL!

Pat. No. 2458276

IT'S A FACT-



with TOMIC you can go from heavy pipe to Thinwall and vice versa without special fittings. Ideal for alteration work and additions.

IT'S A FACT-



with TOMIC you can go from Thinwall to Greenfield or ANY type cable. Ideal for heating installations and factory maintenance.

IT'S A FACT-



with TOMIC, all connections screw together. Will never shake loose.

IT'S A FACT-



with TOMIC, you can snap tubing into couplings in corners or close quarters.

COUPLINGS
No. 310—½″ ● No. 311—¾
No. 312—1″

Do the Job Better!

WITH TOMIC THINWALL CONNECTORS!
NO CRIMP! NO SCREW! NO WRENCH!
JUST TAP OR PUSH IT ON!

Pre-flexed stainless steel lock washer slips on tube with the greatest of ease—makes uniform, safe, permanent vibration-proof 6-point ground around entire tube. OK in concrete slabs. Perfect for cramped or corner locations. No. 10-1/2, No. 11-3/2, No. 12-1



Pat. No. 2458276

TOMIC SALES & ENGINEERING CO.

Detroit, Michigan









Are You Putting Up This Sign Too Often?

Putting this sign up just once is too often.

Most of the time it means a costly shut-down, idle workmen, delayed production, very often caused by the failure of such a low-cost, but extremely vital item as portable cords. U. S. Rubber scientists have engineered U. S. Royal Portable Cords and Cables to give the longest possible life and durability. The flexible conductors are insulated with a high-grade rubber compound, and the conductor assembly is protected by

60% Neoprene jacket vulcanized in lead—thereby assuring maximum density and ruggedness. Rubber fillers are used in all portable cables, and also in the larger sizes of the portable cords. In all cases, the Neoprene jacket is reinforced internally with a strong fibrous braid.

U. S. Royal Portable Cords and Cables have extra efficiency and strength that make them ideal for use on portable electric machinery, tools, lamps, electric sanders and polishers, railroad equipment, and wherever a tough flexible cord is required.

Remember that United States Rubber Company is the only manufacturer of electrical wire and cable to grow its own natural rubber and make its own synthetic rubber and plastics. That's why "U. S." gives you a quality controlled product. Write to address below for your free copy of our general catalog on electrical wires and cables.

UNITED STATES RUBBER COMPANY

Electrical Wire and Cable Department

Rockefeller Center

New York 20, New York

U.S.RUBBER
SERVING THROUGH SCIENCE

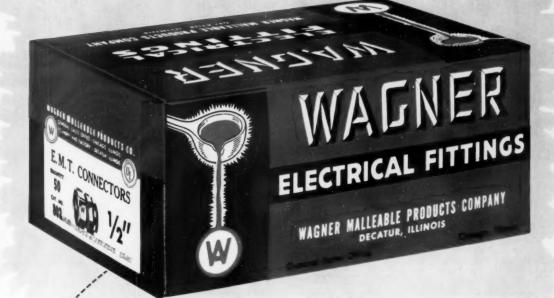




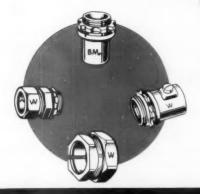


LOOK FOR THIS TRADE MARK





from molten metal to finished fittings
...to user SATISFACTION



Here is the complete line of E.M.T. fittings—all styles—Compression Type- Set Screw Type and BM Indenter. Every operation based on laboratory precision coupled with the benefits of mass production.

WAGNER MALLEABLE PRODUCTS CO.

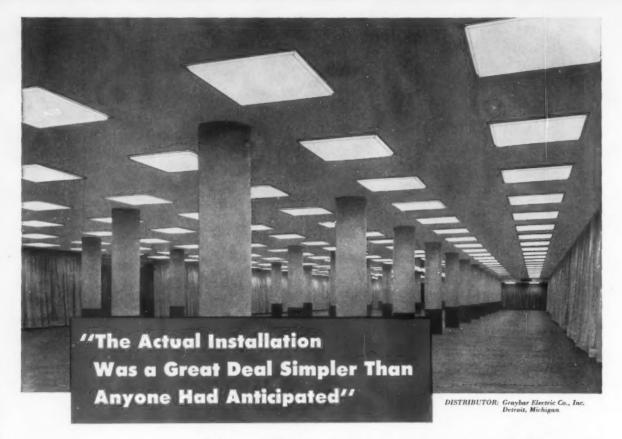
222 West Adams Street, Chicago 6, III. Foundry and Factory, Decatur 60, III.













INSTALLATION DATA

Area-22,400 Sq. Ft. Ceiling height-12'. 217-4' a 4' flush type Bets-Plex units each with 6 4500° cool white 40W-T12 lamps. Beta-Plex Units wired for 3 levels of lighting,

Shortly after installation was completed tests were made and the results were as follows:

: S lamar | Alamar | 2 lamar

		0 100	e p.e.	A remite	v ramps
Horizontal illi	mination	74 ft	-C.	49 ft-c.	25 ft-c.
Vertical illumination		41 ft-c.		27 ft-c.	14 ft-c.
	Fa	ection		Type of M	
Ceiling	85	0		tal acoust	
Walls	62	62%		Existing steel encasement windows	
Dado	25	10			

So Says Brooker Electric Company, Inc., After Installing 217 Wakefield Beta-Plex Units in an Automobile Manufacturer's Display Room

"In undertaking this project we felt that installing and supporting a 4 ft. square fixture would present quite a problem due to the weight of the fixture. However, the actual installation was a great deal simpler than anyone had anticipated.

"The ceiling manufacturer increased the size of the fixture framing channel to carry the weight of the fixture. Wakefield designed the fixture supporting brackets so that they would rest on the framing channel. Consequently, when the fixtures were installed, additional supports for the fixtures that originally were anticipated were not required due to the precise job of engineering performed by the Wakefield Company.

"To the best of our knowledge this was the first installation of its type in this locality, and the Wakefield people are to be congratulated for their accomplishments."

> (Signed) C. RAY DAVISSON, president BROOKER ELECTRIC COMPANY, INC., DETROIT, MICHIGAN

For an illustrated, descriptive 8-page folder on Beta-Plex, write to The F. W. Wakefield Brass Company, Vermilion, Ohio. In Canada: Wakefield Lighting Limited, London, Ontario.

Pakefield Over-ALL Lighting

























Does the tape you're using have all these features?

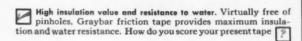
check this list and see!

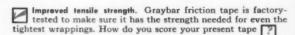
GRAYBAR FRICTION TAPE





No raveling, no undersized rolls.
Graybar friction tape is wound under tension and cut with a neat, smooth edge — it can't ravel and waste tape. Cut to exact lengths, you get guaranteed full footage in every roll. How do you score your present tape







Maximum adhesion. Graybar friction tape grips tight and holds fast. Tests show that 1" Graybar tape unwinds only 1" per minute under a 10-lb. pull. How do you score your present tape



Ages slowly. Graybar friction tape is regularly subjected to electric-oven tests — you can be sure that every roll provides the same degree of long service life. How do you score your present tape

There's a Graybar Tape for every job

AMAZON A.S.T.M. TAPES — Where quality is of prime importance

meets Government Specification
HH-T-101 Grade A.





AMAZON RUBBER TAPE withstands dielectric test of at least 350 volts per mil of thickness... meets Government Specification JJ-T-11C.

GRAYBAR RUBBER TAPE

High dielectric strength. Graybar rubber tape contains no fabric — you get a solid rubber covering of high dielectric strength. How do you score your present tape



High strength and stretch ratios. Graybar rubber tape allows tight wrappings — even on the most irregular surfaces. Test Graybar tape yourself to see how far it will stretch without breaking. How do you score your present tape



Slow aging. Graybar rubber tape is manufactured from special rubber compounds that retain their insulating properties over long periods. How do you rate your present tape



Forms solid, waterproof joints. Graybar rubber tape amalgamates into a solid, impervious mass of rubber. Test it yourself by wrapping it around a pencil. Then try to separate the layers without cutting. It can't be done! How do you score your present tape

Graybar Electric Company, Inc. 420 Lexington Avenue, New York 17, N. Y.

Zone___ State_

Please send me a free sample of Sticka tape and your folder "What to look for in Friction and Rubber Tape."

Name_____Ti

Company__

Address

.

VICTOR TAPES —
for gen ral use



is of uniform quality and is recommended for general commercial use.



victor rubber TAPE
withstands dielectric test of 300
volts per mil of thickness...
gives excellent service
hoth indoors and out.



SEND FOR A FREE SAMPLE.

For a sample of Sticka tape as well as complete information about all the other Graybar tapes, send this coupon.



STICKA FRICTION TAPE—
a reliable, low-cost tape for all your everyday jobs. Buy it by the roll or in the convenient ten-roll package.







WIREMOLD One-Piece Surface Raceways

carry electrical power anywhere—right on the surface!



Wiremold's

big

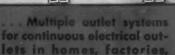


build better business for you

...at a profit!

PLUGMOLD

stores, offices.



Four sizes with capacities up to 10 No. 6 conductors.



PANCAKE Overfloor Raceways

... safest, easiest way to carry power or communication lines overfloor to the point of use.



WIREMOLD Fluorescent Units

... for cove, cornice or valance lighting; for all types of supplementary lighting, such as display cases, shelves, etc.

ALL OVER THE COUNTRY, progressive electrical contractors are using Wiremold's BIG 4 — best way to wire most buildings and the only way to wire many buildings. Write today for full information — see how the BIG 4 will build better business for YOU!

The WIREMOLD Company
HARTFORD 10, CONNECTICUT







THE NEW, IMPROVED Wheeler DURATACH

Complete Interchangeability

New design permits use of any Duratach Reflector with any Duratach Canopy Assembly, thus easily adaptable to any installation.

3 methods hanging

to meet all lighting requirements . . . basic PENDANT installation, with simple onversions to SIDE OUTLET BOX.

each designed to do a specific lighting job

RLM Standard Bowl

RLM 30° Angle RLM Deep Bowl

Elliptical **Shallow Dome** Angle



ECTOR: COMPANY

275 Congress Street, Boston 10, Mass. Distributed Exclusively through Electrical Wholesalers

For complete information write for New DURATACH BULLETIN









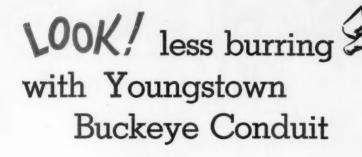
WESTON Instruments

WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. L.



30 megohms...all ranges full scale...
a-c and d-c current ranges extended
with external transformer or shunts.
New temperature compensated rectifier
circuit gives greater a-c accuracy.







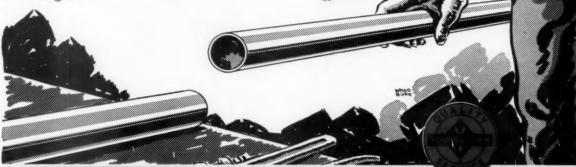
HERE'S WHAT A CONTRACTOR SAYS ABOUT CONDUIT: "We electrical contractors prefer the conduit that gives us a minimum of burring. The fewer burrs, the more hours I save on reaming time. Buckeye Conduit gives a contractor a chance to cut installation costs. That's why I like it."



ELECTRICAL ENGINEER PRAISES BUCK-EYE CONDUIT: "From experience I've found that contractors protect wires better if they use Buckeye. Youngstown makes rigid steel conduit from start to finish. This assures a quality control of manufacture and thus better steel. That is why Buckeye cuts easier and creates fewer burrs."

Take a tip from electrical men! Get Buckeye Conduit for a minimum of burrs and a maximum of protection.

Shipments of Buckeye rigid steel conduit are now being made from our conduit mills at Indiana Harbor and Youngstown.



THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices - Youngstown 1, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel

Export Office-500 Fifth Avenue, New York

COLD FINISHED CARBON AND ALLOY BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - PIPE AND

TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.









There's a Graybar office or warehouse near YOU

Local stocks of standard electrical items and fast delivery on nonstock lines assure on-schedule deliveries. Check the list below for the Graybar office or warehouse nearest you, then make it a point to call Graybar first for everything electrical. Remember, a single source...a single responsibility saves you time and money.

ALABAMA Birmingham Mobile

ARIZONA Phoenix

ARKANSAS Little Rock

Fresno
Long Beach
Los Angeles
Oakland
Socramento
San Bernardino
San Diego
San Francisco
t Santa Ana

COLORADO

CONNECTICUT New Haven West Hartford

DELAWARE Wilmington

DIST. OF COLUMBIA
Washington
FLORIDA
†Fort Lauderdale

*Sales Office

Jacksonville Miami Orlando †St. Petersburg

Tampa GEORGIA Atlanta

Atlanta Savannah IDAHO

Boise ILLINOIS Chicago

Springfield
INDIANA
Evansville

Hammond Indianapolis IOWA

Davenport
Des Moines
Sioux City
KANSAS

Wichita
KENTUCKY
Louisville
LOUISIANA
Baton Rouge

†Supply Store

New Orleans Shreveport

> MAINE Portland

MARYLAND Baltimore

MASSACHUSETTS
Boston
Springfield
Worcester

MICHIGAN

Detroit

Flint

Grand Rapids

Lansing
MINNESOTA
Duluth
Minneapolis

St. Paul MISSISSIPPI Jackson

MISSOURI Kansas City Springfield St. Louis

MONTANA Butte NEBRASKA Omaha

NEW HAMPSHIRE Manchester

NEW JERSEY Newark New Brunswick

NEW YORK Albany *Binghamton Buffalo

"Binghamton Buffala New York City Rochester Syracuse

NORTH CAROLINA Asheville

Charlotte Durham Rocky Mount Winston-Salem

OHIO

Akron
Cincinnati
Cleveland
Columbus
Dayton
Portsmouth

Toledo Youngstown

OKLAHOMA Oklahoma City Tulsa

OREGON Eugene Portland

PENNSYLVANIA Allentown Harrisburg Philadelphia Pittsburgh Reading

RHODE ISLAND Providence

SOUTH CAROLINA Columbia

Sioux Falls

Bristal
Chattanooga
Knoxville
Memphis
Nashville

TEXAS Abilene

> Amarillo Austin Beaumont Corpus Christi Dallas

Dallas El Paso Fort Worth Houston San Antonio

UTAH Salt Lake City

VIRGINIA Norfolk Richmond

Roanoke
WASHINGTON
Seattle
Spokane

Tacoma
WEST VIRGINIA
*Charleston

WISCONSIN Green Bay Madison Milwaukee

416-44

CALL GRAYBAR FIRST FOR ...



Practical Methods

Foreman's Record Kit Speeds Field Paper Work

MANAGEMENT

There can be no question as to the importance of accurate cost records to the successful operation of an electrical construction business. Methods of obtaining such cost data may be questioned at times—particularly information which must, of necessity, come from the field. It may come in late, be incomplete, be on scraps of paper or backs of old envelopes. Some of it may get lost in the shuffle and not

appear in cost records at all. Even when well organized contractors supply field foremen with record forms, they still have difficulty in securing the cost information they want.

This problem has been with electrical contractors for a long time. Some have done nothing about it; others have sought a solution. Boese-Hilburn Electric Co., Inc., Kansas City, Mo., recognized this problem in



its own operations and decided to correct it. John D. Hilburn, president, and G. Kelsey, controller, analyzed the situation and came to the conclusion that management had to do three specific things:

1. Inform the foremen and field men just what information is needed.

2. Tell them frankly why this information is needed.

3. Make it easy for field men to supply this information by giving them all the paper work "tools" in a single package.

Boese-Hilburn's solution was the design of a "Foreman's Ready Red Tape Kit"—and a single package containing all the forms and paper work wanted from the field, an explanation of why this data is required and complete instructions for its use.

The Kit is in book form made from extremely durable pressed cardboard covered in leatherette. Pockets in the leatherette "pages" contain the various forms used in the field. A small, transparent slot on the front of each pocket contains information explaining the purpose of the form and how to fill it out. A leatherette flap attached to the back cover fastens over the front page and keeps the contents from spilling out. The front cover is suitably engraved with the title and company name, address and cut.

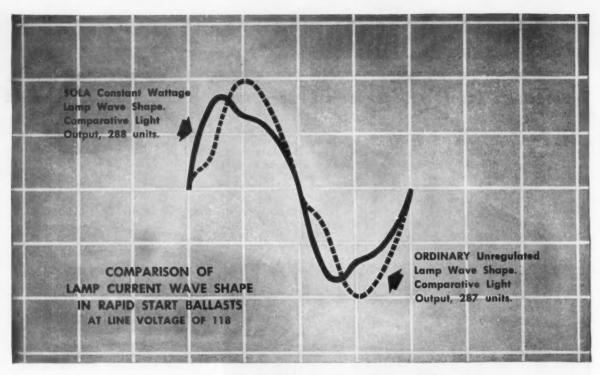
The inside cover is just a half flap, open on one side, for storage of the foreman's own job papers. When the kit is originally issued, this flap contains a general instruction sheet. Page one contains a pocket with a copy of the National Electrical Code and the local union agreement. The front of page two has one pocket containing a pad of receiving report forms; the back has a flap in which postage-paid return envelopes are kept. Page three has two pockets: one with a pad of individual time reports for small jobs, and the other with an extra work



FOREMAN'S FIELD RECORD KIT is part of foreman education project carried on by John D. Hilburn (above), president of Boese-Hilburn Electric Co., Inc., Kansas City, Mo. Kit helps field men get accurate reports in quickly.



CLOSEUP OF KIT showing the leatherette "pages" with pockets and flaps containing the necessary forms and order pads. Also included are a copy of the National Electrical Code and the local union agreement.



Low peak/rms ratio of Sola Rapid-Start Constant Wattage Ballasts extends lamp life

The life of rapid-start fluorescent lamps is inversely proportional to the peak/rms ratio of the lamp's current wave shape. The patented Sola constant-wattage, rapid-start circuit results in a ballast with an extremely low ratio — for example, approximately 1.5 at 118 volts—along with excellent wave shape.

This ballast regulates lumen output within $\pm 2\%$ regardless of line variations from 106 to 130 volts.

Its 300v open circuit voltage, from the lamp to the starting aid, results in positive starting.

A Sola sales engineer will be happy to give you all the illuminating facts.

COMPARISON OF PEAK/RMS CURRENT RATIO, IN RAPID START LAMPS OPERATING FROM SOLA CONSTANT WATTAGE BALLAST AND ORDINARY UNREGULATED BALLAST

LINE	PEAR	SOLA	
VOLTAGE	SOLA	ORDINARY	SUPERIORITY
106	1.308	1.535	42.4%
118	1.472	1.567	16.7%
130	1.552	1.651	15.2%

Reduces relamping . . . keeps lumen output constant

SOLA Constant Wattage
BALLASTS



WRITE FOR BULLETIN 17D-FL-191



Trensformers fer: Constant Voltage • Fluorescent Lighting • Cold Cathode Lighting • Mercury Vapor Lighting • Luminous Tube Signs
SOLA ELECTRIC CO., 4633 W. 16th Street, Chicage 50, Illinois, Bishep 2-1414 • NEW YORK 35: 103 E. 125th St., TRafolgar 6-6454
PHILADELPHIA: Commercial Trust Bidg., Rittenhouse 6-4988 • BOSTON: 272 Centre St., Newton 58, Mass., Bigelow 4-334
CLEVELAND 15: 1836 Euclid Ave., PRospect 1-6400 • KANSAS CITY 2, Mol. 406 W. 34th St., Jefferson 4382 • Reps. in Other Principal Cities

order pad used to secure authorization on extra work. On page four are kept the time report forms which the foreman makes out and from which payrolls are prepared. An "Extra Work Order Material List" form used by foremen is kept on page five. A "Material Transferred" form, used on large projects when material is transferred from one base job to another, stays in a pocket on page six. A slot on the back inside cover contains the foreman's copy of the work order. Overall dimensions of the kit, complete with all forms, is 13 in. by 10 in. by 4 in.

While this specific kit was designed for forms used by the Boese-Hilburn organization, the idea can be applied to practically any type of electrical construction operation. It definitely gives the field foreman what he needs and wants and keeps it in a handy package for ready access and use. And Mr. Hilburn will be glad to allow anyone to use it for a sample or guide in designing a similar kit for their own specific needs.

Do the foremen like the idea? Reaction at a B-H foreman's dinner when the kit was introduced some four

months ago was enthusiastic and all present accepted the idea whole-heart-edly. Field use in the interim has brought numerous compliments from foremen on the value of the kit to their work.

Is management pleased? "We honestly feel that the money we have invested in this book and its presentation will pay more in increased profits than any other kind of investment we might have made," is the answer John D. Hilburn gives to that question, well aware that accurate cost determination is the key to sound business operations.

Aluminum Troughs Promote Wiring Flexibility

DISTRIBUTION

Laboratories, testing centers and similar areas containing numerous work benches requiring considerable wiring, can profitably adopt a distribution method designed by Walter Kidde Constructors and installed by electrical contractors Langdon & Hughes in General Electric's new research and production center at Utica, New York (EC&M. Nov. 1953, "Electronics for Defense").

There, in one of the laboratories where ten rows of test benches are located, each side wall has a central test cubicle, plug board and surmounting pull box measuring approximately 9-hy-3-by-1½-feet. These electrical centers are interconnected via eight 4-by-4-inch wiring troughs that span the

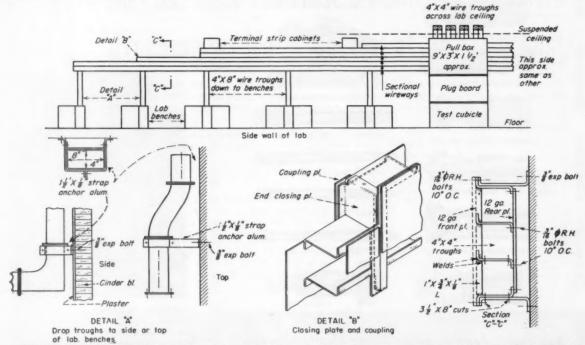
laboratory above the suspended ceiling. Wiring also extends laterally from these two centers, carried along the walls through banks of specially-constructed aluminum wiring troughs to points above the various bench locations, then dropping downwards through 4-by-8-inch troughs to the sides or tops of the bench surfaces.

Since as many as six tiers of troughs are combined in each lateral run, multiple troughs were formed by mounting the required number of horizontal shelves to a 12-gage rear plate, then mounting the entire assembly to the plastered, cinder-block wall by means of formed aluminum strap anchors and \$\frac{1}{2}\cdot \text{-inch expansion bolts.} Tiered shelves are secured to the rear plate by means of \$\frac{1}{2}\cdot \text{-in.} round-head bolts, spaced 10

inches on centers, as indicated in Section C-C of the accompanying sketch. This Section also indicates that shelves are stiffened at their front lips by means of intermittently-spaced 1-by- $\frac{1}{3}$ -by- $\frac{1}{3}$ -in. angles which are welded at the various intersection points.

As wiring banks extend outwards from the central pull boxes, the amount of wiring to be carried drops off as each bench line is reached, so troughs are progressively capped by means of end-closure plates, welded as shown in Detail B. After all wiring has been laid in place, the entire installation is capped by means of a 12-gage front cover, secured to top and bottom trough lips by means of fa-in. RH bolts.

Also, as benches are progressively reached, the tiered wiring shelves are



ALUMINUM WIRING TROUGHS are light-weight, easily fabricated, neat in appearance, rust-proof, readily installed and quickly mounted. Front and rear plates are bolted to shelves and to mounting anchors, while stiffeners and end-closure plates are welded into position.



ANCHORING and DRILLING DEVICES

Always Specify ARRO









- Million

O-E EXPANSION SHIELD



MACHINE SCREW ANCHOR



STUD BOLT ANCHOR



LEAD SCREW ANCHOR



MAL-LEAD BOLT ANCHOR



TWO WING

SPRING-TYPE

OGGLE BOLT

SPRING HEAD

RIVETED HEAD

STEEL TOGGLE BOLT

See your industrial, hardware or electrical supplier

ARRO EXPANSION BOLT COMPANY

1540 Boone Ave., Marion, Ohio

pierced with 3½-by-8-in, openings to permit wires on the various shelves to be turned downwards towards the various benches, and vertical 4-by-8-in, troughs are bolted to the bottom of the trough assembly. These short vertical troughs are mounted to the laboratory walls in the same manner as main anchors, with aluminum straps and expansion bolts used as the supporting means.

The completed installation is compact and attractive in appearance. Constructed of light-weight aluminum, it was easy to form, drill, cut and erect. And, with front plates readily removable, maximum wiring flexibility is provided for this important research area.

5 Minutes Per Hole With a Diamond Core Bit

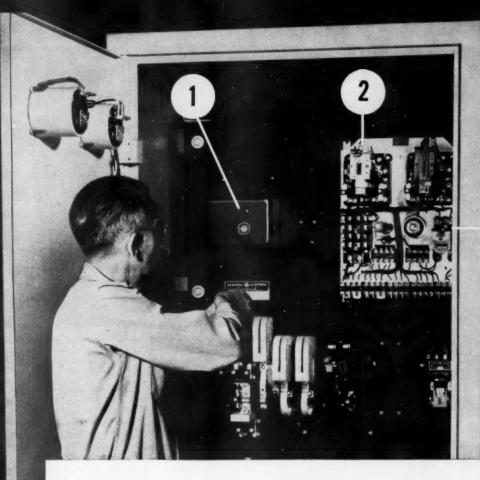
INSTALLATION

When electrical contractor Howard P. Foley installed the distribution system at 525 William Penn Place, Pittsburgh, it was necessary to drill thousands of 2½-inch holes through the various concrete floor slabs and the supporting Robertson "Q" channels beneath them, in order to locate receptacle outlets, branch riser points and floor plugs. This mass-production undertaking involved an average time of 5 minutes per hole, and the tool used to accomplish it was a portable electric Penndrill, model E, using diamond coring bits.

As indicated in the accompanying illustrations, the drilling assembly is mounted to a pipe support which, in



VERTICAL DRILLING in floors finds the pivoted pipe stand in an upright position, held secure by means of an inclined brace that extends from the rear of the castered base frame to the top of the pipe. Hand clamps permit movement of the drill along the pipe. (Fig. 1)



Only G.E. Gives You These 3 Features in Standard Synchronous Motor Control at No Extra Cost

- 1. GRADUATED SQUIRREL-CAGE PROTECTION Relay protects motor during stall or subsynchronous operation. Protects squirrel-cage winding against overheating.
- 2. PRECISION ANGLE SWITCHING Field application relay takes fullest advantage of motor's synchronizing ability-applies field at correct speed and most favorable angle between rotor and stator poles.
- 3. LOAD ANGLE FIELD REMOVAL Fastest field removal available assures long motor life. Power-factor relay removes field within first half slip cycle out of synchronization.

You get these and other big features in standard G-E synchronous motor control at no extra cost. Be sure to get complete details-con-

tact your nearest G-E Apparatus Sales Office or use the convenient coupon to get our new 16page desciptive bulletin.

Section E-780-3 General Electric Company Schenectady, N. Y.

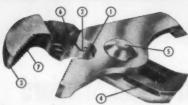
Please send me your new bulletin, GEA-5873 which gives complete information on G-E Synchronous Motor Control.

Position.

Company.

GENERAL (%) ELECTRIC





kerės włuj

1. Interlocking principle prevents slipping under any load. 2. New type wide base lugs cannot shear. 3. New nose design for gripping small objects. 4. Patented design of tension edge eliminates stress concentration at channels. S. Interlocking design minimizes stress on joint bolt. 6. Precision machined interlocking surfaces result in perfect fit, distributing pressure evenly. 7. "Rite Angle" teeth guarantee maximum bite and minimum wear, Look for the Channellock line when you're shopping for hand tools. Channellock pliers offer features that you can't get with other makes. And when you buy a Channellock plier, ask to see the full line-you'll find a style and model to do any job better.



THE PLIER DESIGN THAT OBSOLETES ALL OTHER CHAMPION DOARMENT TOOL CO. . MEADVILLE, PA.



HORIZONTAL DRILLING into walls is possible by loosening the brace, folding it down along the base, then pivoting the pipe stand downwards until it rests in the rear cradle. Movement of the drill forward or backward is controlled by lever action. (Fig. 2)

turn, is mounted to a plate and channel-framed base. By loosening and tight-ening two hand clamps, the drill may be moved along the pipe and secured at any desired position. And, since the drill-supporting pipe pivots at a point approximately a foot above the base, the drill may be directed either horizontally or vertically into walls or floors, and a lever makes it possible to advance or retract the bit as desired. Movement of the entire unit from location to location is facilitated by means of rubber-covered ball-bearing casters.

When used for floor drilling (Fig. 1), the drill-supporting pipe is held vertical by means of a 2-section adjustable-length brace that extends

from the rear of the base frame to the upper end of the pipe. When used for wall drilling, however, the bar brace is loosened and collapsed to its minimum length, it is folded down along the base frame as shown (Fig. 2), and the drill-supporting pipe is pivoted backwards and downwards until it comes to rest in a yoke cradle, and the drill assumes a horizontal working position. Since the drill may be moved around the main pipe as well as along its length, it is apparent that the height of holes to be drilled in a wall can be regulated exactly. This drill operates at 110 volts ac, although other units may be obtained for 230 volts, or for

French Drains for Underground Conduit

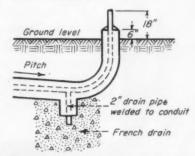
INSTALLATION

Among scores of practical installation methods included in the design of Chevrolet's impressive 30-acre assembly plant in Cleveland is the use of French drains for eliminating condensation in underground ducts and conduits. As indicated, the drain point is located at the low position of the underground run and, in this case, a 2-inch conduit stub is welded to the drilled conduit on the underside. Loose rock is placed around and beneath this stub so that any condensed moisture rapidly trickles away from the drainage hole. In cases where ducts and conduit sweep up at utilization points, the conduit is carried above grade level for at least 18 inches, while the duct or concrete sheath is carried up six inches.

In using this method, it is necessary

to make sure that the surrounding soil affords good drainage so the drain pipe won't be clogged by silt.

The technique was practiced by Hatfield Electric.



DRAIN PIPE, welded to low point of underground conduit, then surrounded by loose rock and gravel, insures removal of condensate from raceways.



elboard of a General Electric secondary distribution system is a leader in its field in its own right. Put them together and you gain still more from complete integration. For all these products are engineered to work together as a system... all the way from transformer to point of use. This is your complete assurance of all the flexibility, reliability and safety that can be built into this vital area.



G-E Motor Control Centers provide convenient, compact grouping of motor starters, other control equipment and feeder protection. They assure maximum safety, adaptability and convenience.

G-E Busway Systems fit the needs of each load area, yet permit system expansion with factory growth.



G-E Lighting
& Distribution
Panelboards,
fusible or circuit-breaker
types, provide positive
circuit control and protection.



FOR COMPLETE INFORMATION, WRITE GENERAL ELECTRIC COMPANY, DISTRIBUTION ASSEMBLIES DEPARTMENT, PLAINVILLE, CONN.

Make it G.E. all the way through the vital low voltage area from transformer to point of use.

GENERAL ELECTRIC

Motor Shops

Lathe and Geared Rollers Used to Wind Spools

Since the Central Armature Works of Washington, D. C., purchases large quantities of small-diameter wire, it is purchased in bulk on reels of considerable size and capacity. However, for greater convenience of handling at the various benches and winding machines, it has been found desirable to rewind the wire from the large reel onto smaller spools prior to actual use in

the shop. This was formerly a laborious chore and frequently resulted in an uneven rewind job with attendant snarls on the spools. However, due to the development of a simple device which was constructed in the shop, winding wire from the large reel to smaller spools is now accomplished accurately, neatly and quickly.

The winding device consists pri-

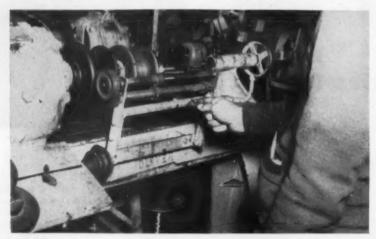
marily of a strap-iron framework which is secured to the front of the bench that supports the lathe. This framework is pivoted so that it may be easily raised when in use, then dropped out of the way when not needed. The framework supports two 1-inch diameter rollers in end bearings, and meshing gears secured to one end of these rollers causes the rollers to rotate simultaneously but in opposite directions. The rollers are also fitted with sliding collars that may be moved left or right and secured in any desired position by set screws. The end of one of the rollers is also fitted with a pulley wheel which, when pressed against a larger wheel mounted on the shaft held by the lathe, causes the two rollers on the framework to spin in opposite directions.

When preparing for a rewinding job, the rollers being wrapped with wire, the top roller being wrapped from right to left, the bottom roller from left to right. The small spool to be rewound is then placed on the lathe shaft and the adjustable collars on the rollers are positioned to coincide with the edges

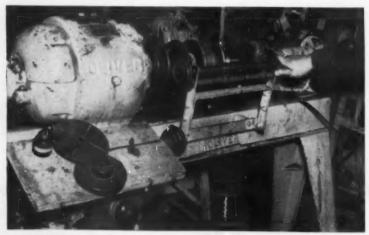
of the small spool.

The actual rewinding job is then a simple operation for the operator. He flips the framework up to bring the pulley wheel in contact with the wheel on the lathe shaft, passes the lead end of the wire coming off the large reel between the rollers and around one end of the spool core, then starts the lathe motor. When the operator raises the wire being rewound, it comes in contact with the wire grooves on the wrapped upper roller and, following these grooves like the grooves of a thread, the wire being rewound moves uniformly from left to right. When the right side of the spool has been reached, the operator lowers the lead wire and it then comes in contact with the lower roller that has been wrapped from right to left, thereby returning to the left side of the spool again.

Once the set-up is made, the operator need only raise or lower the lead wire as it alternately reaches the left or right side of the spool, and the rewinding is completed evenly and quickly, without snarls and without piling up in any one section. Many small spools can be rewound at the same time, so the operation need not be performed too frequently.



ROLLERS are wrapped with wire, one being wrapped from right to left, the other from left to right. In effect, this establishes a series of spiral grooves, like those of a thread so that, during a rewind operation, a wire passed between the rollers and around the core of the spool held by the lathe shaft will move evenly from one side to the other and back again as the lead wire is raised or lowered to come in contact with the thread required.



FRAMEWORK, pivoted to front of lathe bedplate, brings pulley wheel in contact with drive wheel mounted on lathe shaft. Since pulley is mounted on one of the two rollers that are mounted on the framework and geared together, the rollers revolve in opposite directions.



Quinterra and Quinorgo Electrical Insulations lengthen service life...simplify production...cut costs

Quinterra is the pyrolysis-resistant dielectric that helps cut electrical apparatus costs. More and more manufacturers are using it to make apparatus smaller and safer, at lower cost. Its composites are being used in Class "B" and Class "H" motor rewinding. It permits equipment to operate at higher temperatures because it remains a dielectric despite

heat and time . . . the bulk of its dielectric strength is in the purified asbestos base sheet. Its mechanical strengths, thinness and flexibility permit economical application.

Quinorgo is the moderate priced, high temperature insulation for use alone or in composites. Designed for operating temperatures up to 130C, it combines high dielectric and mechanical strengths. High in absorption capacity, it can be readily treated and combined with other dielectrics. Furnished only in untreated form.

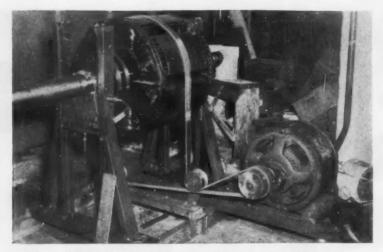
Send for your free copy now! This new booklet is offered without obligation to electrical equipment designers, engineers, manufacturers and motor repair shops.

Johns-Manville

PURIFIED ASBESTOS

ELECTRICAL INSULATIONS

Johns-Manville, Box (In Canada, 199 Bay S	50, New York 16, N. Y. EC-4
Please send me with "Pyrolysis Protection	out charge copy of booklet EL-40A.
Name	Title
Name	



Shop-Made Balancer Has Simple Construction

Armatures up to 400 hp are balanced on a shop-made assembly in the repair department of Central Armature Works, Washington, D. C. Crating on the principle of recorded vibration, the unit consists essentially of two arbors, equipped with bearings to hold the armature shaft, a 15-hp motor which is used as a driving unit, pulleys mounted on a base beam around which a drive belt is run, and a vibration meter which measures the force pulsations of the two bearings during the period of the balance test. Under normal conditions both ends of the armature shaft rest on the bearings with no other holding force applied except that of gravity. However, for exact

checking, either side of the shaft may be held firmly by clamping the top bearing cap in place. The framework of the device is constructed from channel iron members fastened together either by welds or bolts. This unit, while it does not combine all of the automatic features found in assemblies developed by commercial manufacturers, removes much of the trial-and-error detail which otherwise would be necessary and it is proving to be a useful piece of low-cost equipment in this shop.

Coils Pulled With Cam-Operated Tongs

Coils are pulled from stator slots cleanly, quickly and easily, in the shop of Queens Electric Motors, by means of cam-operated tongs, a unique motor holding arrangement, and a caustic tank where coils are soaked overnight after their knuckles have been cut. The tank, an Aeroil heating unit, is gas heated with electric ignition. It is equipped with a time clock, temperature controls and a large-capacity exhaust to conduct fumes from the fireproof vault in which this equipment is located.

After overnight soaking, insulating varnish is dissolved to the extent where the binding properties are negligit le and little resistance is experienced when coils are pulled from the slots. In the pulling process, the stator is merely rested on two parallel rollers, with the shoulder of the stator frame resting against angle iron members drilled with a series of holes that permit the rollers to be spaced closely together or separated by any desired distance. This makes it possible for the same frames and rollers to hold any stator of any diameter. Under the majority

of conditions, no other restraining force, other than gravity and the angleiron end members, is necessary to hold the stator securely. However, in those few cases where added force is required, a belt chain is available to wrap around the motor frame and prevent the unit from shifting or tipping during the coil-pulling process.

The pulling tongs are fastened to the end of a short length of chain which is, in turn, fastened to a cam-operated mechanism that moves back and forth in tempo with a flywheel turned by a one-horsepower motor. The operator engages the coils with the tongs during their forward motion,

Coils, as they are pulled from the slots, may be dropped into a metal container located immediately beneath the stator rack.



STATOR, with damaged coils already cut at one end and softened by caustic bath, is held in roller cradle either by combined restraining forces of gravity and angle irons, or by link chain.



ROLLERS of cradle are held by angle iron frames and can be moved inward or outward easily. Angles on one end are drilled, with high shoulder acting as a restraining barrier to prevent the stator from slipping. Angles at other end are notched, permitting easy lifting and moving of roller shafts.



VIBRATION of the bearings is measured while the armature is revolved and brought up to various speeds. While armature shaft usually rests on pillow blocks without benefit of upper bearing caps, these may be clamped in place for more exact measurements.

DRIVE-IT **SAVES 30% IN LIGHTING INSTALLATION COSTS!**

Electricians in new Northwest factory use DRIVE-IT 320 for overhead installations. 18,000 pins were used on fixtures



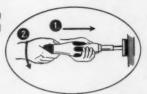
DRIVE-IT 320 BREAK-OPEN ACTION

Snap open action results in the fastest operating tool on the market. Easiest method to load and eject cartridges under any condition.





Exclusive Safety Pads developed for specific jobs such as conduit clamp, brackets, or fuse boxes.



SEND

THIS COUPON

FOR FULL

DETAILS

City.

Three-way Safety. Cannot be discharged accidentally, due to the push and turn firing sequence. This, plus the large, swivel safety pad, makes DRIVE-IT triple safe.

More fastenings per hour with this speedy way of loading and ejecting cartridges.

DRIVE-IT

the original POWDER-ACTUATED TOOL

POWDER POWER TOOL CORP.

Dept. I, 7526 S.W. Macadam Ave., Portland 1, Ore.

Canada: Ammo Power Tool Co., Ltd. 735 Broadway, Vancouver, B. C.

Please send FREE catalogue and literature. I want a FREE demonstration of DRIVE-IT.

Name.

State_

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1954

SELL THE FANS THAT HAVE BEEN PLEASING CUSTOMERS

For 77 Years

Since 1877, the name "Buffalo" has stood for good, dependable equipment. Today, you can offer a modern, highefficiency "Buffalo" Fan for almost any air handling job your customers could call for—from kitchen and attic fans to large ventilation fans and exhausters. Below are two "Buffalo" Fans popular for their easy installation, high delivery and low maintenance costs.



BUFFALO FORGE COMPANY

520 Broadway

Buffalo, N. Y.



PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING FORCED DRAFT COO

G AIR TEMPERING

INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

Ferris-Wheel Combines Wire Storage and Pay-Out

Twenty-four hundred pounds of magnet wire are stored ready for immediate pay-out to a winding head in the motor repair department of the Wm. C. Krauth Electric Company, Louisville, Kentucky. As many as eight different sizes (or more, depending upon reel arrangement) are mounted on a rotating rack requiring less than 12 square feet of floor space. Once specified wire size is selected, the mechanic merely turns a hand crank until the reels "turn up" facing the winding machine. There's no bending, lifting or hustling of heavy reels from storage rack to pay-out frame and back again.

A 39-inch diameter ferris-wheel rack permits this operating flexibility and time economy. The octagonal periphery of each wheel is constructed of 2-inch angle-iron. Spokes of 2-inch flat-iron terminate at a center hub. Four spacer rods separate the two wheels of the assembly and maintain the required 30-inch "spread" to accommodate three standard 12-in. magnet wire reels, side-by-side.



FERRIS-WHEEL RACK stores 2,400 pounds of magnet wire on 24 reels in instant pay-out position behind winding head. Supporting frame takes up about 12 sq. ft. of floor space.



HAND CRANK coupled to simple gear train with a five-to-one ratio positions selected size of magnet wire for de-reeling onto winding head. Bar between spokes of octagonal wheel keeps reels in place.



Neoprene jacketing protects wiring against moisture, heat and chemicals in paper mill

Extreme conditions of exposure proved too much for Type RW wiring jacketed with saturated cotton braid used in "wet locations" of the Ecusta Paper Corporation in North Carolina. Moisture, heat and chemicals caused wiring to fail after five or six years.

Then neoprene-jacketed wiring was installed, and failures on this wiring have been practically non-existent. In the bleach building shown above, for example . . . even after six years of exposure to hot, steamy air, daily hosings, chlorine and caustic soda . . . neoprene-jacketed wiring continues to give trouble-free service.

Now Ecusta uses neoprene-protected wiring exclusively in wet locations. During the last six years, many thousands of feet of this wiring have been installed—for 600-volt A.C. power and control circuits, and for all 5000-volt A.C. feeder circuits.

FOR OUTSTANDING DURABILITY, specify neoprene-jacketed wire and cable. Rugged neoprene withstands soil acids and abrasion in the ground; exposure and sunlight in the air; heat, grease and chemicals anywhere. See your supplier about neoprene-jacketed wire and cable. They're available in voltage ratings to fit your specific needs.

free! THE NEOPRENE NOTEBOOK. Each issue describes interesting applications of neoprene . . . new products . . . on-the-job reports. Add your name to the mailing list. Just clip and mail the coupon below.

MAIL THIS COUPON TODAY

NEOPRENE

The rubber made by Du Pont since 1932



BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

E. I. du Pont de Nemours & Co. (Inc.)
 Rubber Chemicals Division EC-4
 Wilmington 98, Delaware

Please add my name to the mailing list for the Neoprene

Name______Position_____
Firm_____
Address____



More contractors use Ramset than all other makes combined . . . because of utility, speed and economy

Contractors using high-speed RAMSET SYSTEM for fastening into steel and concrete find that it "pays off" in at least three ways. That's because RAMSET:

- Increases profits by reducing costs.
- 2. Enables lower figuring on competitive work.
- 3. Saves money for its users.

The advantages of RAMSET SYSTEM are so superior that in a nationwide check of users of powder-actuated tools, 57% of contractors prefer RAMSET over all other makes combined. They like RAMSET because of:

Tools matched to the work—three sizes of RAMSET JOBMASTER Tools

offer widest utility for light, medium or heavy work.

Widest range of fasteners—permitting fasteners to be closely matched to the job.

Balanced power charges—varied in strength to suit materials, tools and fasteners.

Finest field service—prompt, competent, on-your-job suggestions for fastest, easiest, lowest cost methods.

You can be sure of maximum economy and time saving by using RAMSET SYSTEM for fastening into steel and concrete. See your RAMSET dealer for demonstration or write us for details.

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.
12105 BEREA ROAD • CLEVELAND 11, OHIO

FIRST IN POWDER ACTUATED FASTENING





DUAL PILLOW BLOCKS support crank shaft on angle-iron post. Shaft gear is $3\frac{1}{2}$ -in, diameter; drives $17\frac{1}{2}$ -in, diameter gear on side of ferris-wheel assembly.



TENSION BLOCKS are clamped to extended bracket arm; can be quickly shifted along arm for alignment with desired group of magnet wire reels.

Eight reel supports are incorporated in the rotating rack. A length of 1-in. pipe is centered on each face of the octagon. Cotter pins at each end facilitate removal for reel replacement. A total of 24 12-inch reels are normally stored on the rack. Wire sizes range from No. 15 through No. 21.

It takes a lot of muscle-power to turn a wheel containing some 2,400 pounds of copper, even when weight is evenly distributed. Should there be an unbalance due to heavier reels on some supports, it would be even more difficult and the danger of backlash is present. Mechanics might get their hands caught between wheel spokes and supporting frame. To eliminate this possibility and make it easier on personnel, Krauth added a removable hand crank and simple gear train to one side of the unit. A 31-in, diameter gear on the crank shaft meshes with a 17½-in. diameter gear on the wheel; permits the mechanic to rotate the unit through relatively small arcs to position required wire spools. pillow-blocks securely anchor the relatively short crank shaft to the support upright. A bar, inserted between spokes and frame, brakes the wheel in position.

The ferris-wheel unit is supported by a sturdy box-frame with 3-inch angleiron uprights (60 inches high) and flat-iron bracing. Actual measurements at the base are 36-in. by 41-in. The wheel axle is 52½ inches above floor level and some 25½ inches back of the front uprights; an arrangement providing space at the bottom of the frame for de-reeling other spools of wire and clearance at the front to apply de-reeling tension. An extended bracket arm bridges the frame; supports an adjustable tension block which can be quickly positioned to serve any group of reels.

Coil Forms Collapsed By Cam Arrangement

Mush coil forms are collapsed instantly, permitting the rapid removal of the wound wire assemblies, then forms are returned to their initial relative position with, literally, the "flick of the wrist," in the repair shop of Walter Leirer's Queens Electric Motors. This is accomplished by means of a cam that moves the two halves of the form simultaneously inward or outward when it is revolved.

The distance between the form segments is easily regulated by a handwheel attached to the end of a wormscrew which has a reverse thread, that is, one on which the direction of thread on one end of the wormshaft is opposite to that on the other end. Since the two halves of the form are geared to this shaft, the revolving of the shaft shifts each segment inward or outward an equal distance.

The use of the cam makes it unnecessary to loosen any nuts at the completion of a coil-winding procedure, and the forms may instantly be returned to their former position.



HANDWHEEL on wormshaft having reverse thread makes it possible to regulate distance between form segments accurately and rapidly. Forms are collapsed after coil-winding, then immediately returned to their desired separation by means of a cam arrangement.

NEW-Improved Case for MIDGET MEGGER® Insulation Tester



The ever-popular Midget Megger Insulation Tester is packed in a leather case of new design. As with a fine camera case you simply flip back the lid of the case and the instrument is ready for use. The leads are stored in a compartment under the instrument. The Midget Megger Test Set contains its own unfailing source of test current in a hand generator. No dependence on batteries or other power supply.

Ratings up to 50 megohms, 500 volts d-c are available.

Write for BULLETIN 21-85-ECM

GET THIS COMPLETE
FILE OF HELPFUL

BULLETINS ON



ELECTRICAL PREVENTIVE MAINTENANCE

Written by Practical Electrical Men

Check and mail this ad with your business letterhead.

- Bulletin 21P8—"The Story of Electrical Insulation Resistance"
- ☐ Bulletin 21P9—"Maintenance of Industrial Electrical Equipment"
- Bulletin 21P10—"Cut Electrical Breakdowns"
- Bulletin 21P11-"Getting the Most From Insulation Resistance Measurements"
- ☐ Bulletin 21P12—"Preventive Maintenance of Electrical Equipment"
- □ Bulletin 21P16—"Motor Maintenance with a Check Chart for Alternatingand Direct-Current Motors"

You can tell from Megger Insulation Tester readings if insulation is going bad before it breaks down. Periodic readings provide the means for keeping your finger on the pulse of your electrical equipment. Saves time and repair bills.

JAMES G. BIDDLE CO.

ELECTRICAL TESTING INSTRUMENTS

SPEED MEASURING

INSTRUMENTS

LABORATORY & SCIENTIFIC EQUIPMENT

1316 ARCH STREET, PHILADELPHIA 7, PA.

James G. Biddle Co. 1316 Arch St., Phila. 7, Pa.

Gentlemen: Please send me

☐ Bulletin 21-85-ECM
☐ Midget Megger Case(s) @ \$11.00
☐ Check attached ☐ Bill Company

NAME

JOB FUNCTION

COMPANY ADDRESS

B-411

INCREASING USE OF ELECTRICITY CALLS FOR MODERN DISTRIBUTION SYSTEMS

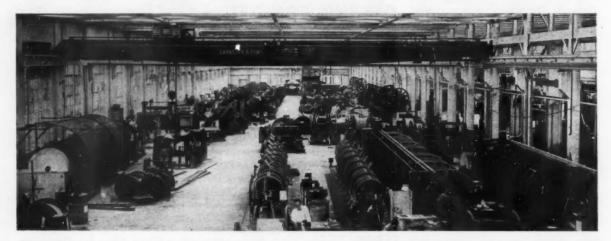
General Electric's expanding wire and cable facilities and services can help you serve your customers

The continuing development of new electrical equipment, processes, and materials handling methods doubles the use of electricity about every ten years—according to the findings of qualified authorities. This growing load will call for bigger and more flexible distribution systems and wire and cable installations. To help you serve your customers, General Electric has expanded its facilities, and is prepared to assist in the application, use, and maintenance of modern distribution systems.



1 PLANNING AND APPLICATION.

G-E wire and cable specialists are ready to help you select and plan cable systems with the capacity and flexibility needed for growing loads.



2 WIRE AND CABLE AVAILABILITY.

General Electric is adding a new wire and cable plant to its facilities in Bridgeport, Connecticut, to continue to supply you with the products on which cable systems depend. This new plant will be able to produce more cable faster, and will supply you with new cable products to meet new needs.

If you want help NOW . . . just call your G-E wire and cable specialist, or write Section W123-418. Construction Materials Division, General Electric Company, Eridgeport 2, Connecticut.





MAINTENANCE OF CABLE SYSTEMS.

G-E test facilities minimize your customers' maintenance problems. Thorough production-line testing, coupled with research and developmental testing, give you wire and cable products with longer life and coordinated insulation levels. (This spectrographic test for copper conductor purity is one example of G.E.'s laboratory testing.)

FOR MORE INFORMATION ON

NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

USE THESE CARDS

• PRODUCT NEWS, PRODUCT BRIEFS:

Use first line of boxes, Insert item numbers of products on which more information is desired.

CATALOGS, BULLETINS AND ENGINEER-ING DATA:

Use second line of boxes. Insert item numbers of literature desired.

ADVERTISEMENTS:

Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

IMPORTANT...

- PLEASE PRINT LEGIBLY
- . USE BLACK OR DARK BLUE INK
- O DO NOT USE PENCIL OR RUBBER STAMP

Product Nev	visinout oblig vs and Produ				The Tellow	ing: 4/84
Catalogs an	d Bulletins,	Item Numb	er			
Advertisem	ent on Page					
				$\neg \sqcap$		
IAME				. TITLE		
OMPANY						
DDRESS						
ELECTRICAL	CONSTRUCT	ION AND	MAINTE	NANCE - A	McGraw-H	II Publication
Joseph March				JUNE 1, 1		
lease send me v	eithout oblic	action furt	her inform	nation abou	at the follow	ing: 4/54
	ws and Produ					
TIOUSG NO		, i				
Catalogs a	nd Bulletins,	Item Numb	190			
Advertisen	ent on Page					
NAME				TITLE		
COMPANY						
ADDRESS						*******
ELECTRICAL						lill Publication
	NC	JI GOOD	AFTER	JUNE 1, 1	734	

Your Name and address are photographically reproduced and sent to the appropriate manufacturers.

Illegible or incomplete addresses may result in your not receiving the information you desire.

STAMP HERE

The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N.Y.

PLACE 26 STAMP HERE

The Editor
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd St.,
New York 36, N.Y.

Your Name and address are photographically reproduced and sent to the appropriate manufacturers. If egible or incomplete addresses may result in your not receiving the information you desire.

FOR MORE INFORMATION ON

NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

USE THESE CARDS

• PRODUCT NEWS, PRODUCT BRIEFS:

Use first line of boxes, Insert item numbers of products on which more information is desired.

CATALOGS, BULLETINS AND ENGINEER-ING DATA:

Use second line of boxes. Insert item numbers of literature desired.

ADVERTISEMENTS:

Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials,

IMPORTANT...

- · PLEASE PRINT LEGIBLY
- . USE BLACK OR DARK BLUE INK
- DO NOT USE PENCIL OR RUBBER STAMP

Product News



Raceway

A new line of wireway and auxiliary gutter, called National 6x6 Wirewa, provides flexibility of distribution and permits relocation of plant electrically powered equipment at lower cost. Designed to allow greater capacity, it is made in lengths of one, two, and five feet. Various fittings for "T", "L", and cross-over and junction boxes are available. Raceway is die-formed from .078 steel and finished in baked gray enamel. For use in corrosive locations, Wirewa is made of galvanized steel. A special adapter for use with the 4x4 Wirewa has also been introduced.

National Electric Products Corp., Gateway Center, Pittsburgh, Pa.



Rerated Motors

A complete new line of alternating current, squirrel cage induction motors in frame sizes 326 and smaller designed to meet the new NEMA standards of smaller frame sizes. Units include the open (Type G), totally-enclosed fan-cooled (Type GZ), and explosion-proof (Type GZZ) motors. They have cast-iron frames and end shields, pressure-cast aluminum rotors and grease-lubricated, medium series, double-shielded ball bearings which can be lubricated without dismantling motor. Stator windings are of the random or mush wound type of heavy Formvarcoated wire in semi-enclosed slots, multiple dipped and baked for moisture protection. Open type frame has air

intakes in bottom half of end shields.

New motors in frame sizes 182 and 184 (1 to 2 hp, 1800 rpm, inclusive) will be available about April 15th; larger sizes will become available at approximately five-month intervals in two-size steps.

Allis-Chalmers Manufacturing Company, Norwood, Ohio and Milwaukee, Wis



Fluorescent Fixture

A new series of 2-lamp, 4- and 8-foot fluorescent luminaires called "The Garfield." Designed primarily for ceiling mounting, the unit has an overall depth of 3%-in., width 121-in. for the 2-lamp unit. Unit is for use where low ceilings necessitate a shallow illuminating source. Side panels of diffusing polystyrene and a bottom louver with 35° by 35° shielding combine to give unit a comfortable brightness pattern. It may be suspended from hangers when a pendant mounted direct luminaire is required. Units may be individually mounted or mounted end-to-end to form a continuous row. Available either with 96-in, slimline or 40-watt bi-pin lamps. It is listed by Underwriters' Laboratories. Inc. Data sheet is available.

Pittsburgh Reflector Co., 404 Oliver Bldg., Pittsburgh 22, Pa.



The Add-A-Panel is a metal board for domestic and industrial use. Switches are lined up and fastened to panel with sheet metal screws. It can be fastened direct to sill plate or used with the special hanger to attach to joists, to brick or cement walls with lead shields and wood screws. For housing projects, equipment can be mounted and wired in shop. The panel surface with its $\frac{3}{8}$ -in. holes provides easy mounting and perforations give circulation of air to back of switches. It can be used for all types of switches and controls, also instruments.

Hales Electric Co., Orange, Mass.

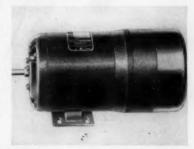


Connectors

(5)

New $\frac{3}{8}$ -in. 45° Harbot connectors for attaching armored cable to knockout boxes in electrical installations. Made of a special aluminum die-cast alloy. Each of the two parts has a grooved lip which engages the edge and inside surface of a standard $\frac{7}{8}$ -in. knockout opening. Operating on a cam-wedge principle, it is possible to install connector from outside of box after wiring hook-up is completed. Connectors have Underwriters' approval.

Unimatic Corporation, 52 East Centre St., Nutley, N. J.



Motors

(6)

Motors can be furnished in the NEMA 42 frame with motor mounted magnetic brakes. Designs include both open and enclosed brake motors, single and three phase, with either foot mounting or with NEMA type C face mounting. All motors are equipped with pre-lubricated ball bearings. This line of motors incorporates the new 40 Series brake which is being introduced by Stearns Magnetic Inc. Maximum torque rating of brake is 1 ft.-lb., adjustable down to 6 in.-lbs. Brake is of spring set, magnetically released solenoid type incorporating the same internal mechanism used on larger Stearns brakes. The brake has an external manual release device and brake enclosure is totally enclosed.

Doerr Electric Corp., Cedarburg,

anygment I

MODERN FITTINGS

Midwest Electric Mlq. Company

MANUFACTURERS OF ELECTRICAL WIRING PRODUCTS

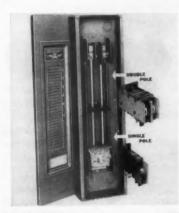
Chicago 12, Miliosis



Nurses' Call System (7)

A new nurses' call system for hospitals has been announced. Built around standard components, this system provides two-way voice communication between nurse and patient. An automatic selector "homes" on any station operated, and the nurse may answer any call simply by lifting a telephone type receiver and speaking. Room stations are designed for mounting in standard outlet boxes, and are automatically reset when a call is answered. Nurses' answering stations may be placed at various locations, and consist of a telephone instrument and a wall or deskmounted annunciator. The system operates through a control panel designed to plug into regular hospital power supply. All terminal strips and internal wiring are installed at the factory, and all electronic equipment is of plug-in design for ease of maintenance. Bulletin 125 available.

S. H. Couch Co., Inc., N. Quincy 71, Mass.

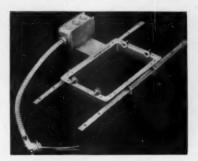


Load Center (8

A new service entrance XO-62 circuit breaker load center for larger homes. Paragraph 2361 of the N.E.C. requires that the entire service be disconnected by no more than six operations of the hand. In this new device, six double-pole breakers at top of load center are labeled to serve this purpose. One of these double poles

feeds up to ten single-pole, 120 volt ac circuits (located in a split bus section below the six main breakers), for household light and receptacle loads. The remaining five double-pole circuits can be used to supply such 220-volt loads as a range, dryer, water heater, air conditioner, room heater, etc. Each circuit is switched and protected by XO circuit breakers. The automatic thermal-magnetic trip element gives complete protection to the wiring for both overloads and shorts. Each unit has an additional bi-metal which compensates for varying ambient temperatures of different installations.

Square D Company, 6060 Rivard St., Detroit 11, Mich.



Pre-Wired Assembly (9)

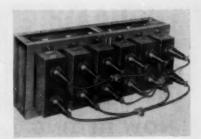
A new pre-wired assembly unit for recessed incandescent lighting fixtures. Unit has been designed to effect substantial savings in materials and labor time. It is installed in a few minutes by hammering in four nails. Supply leads are brought directly to fixture assembly box. The J-box is always accessible. Assembly is U.L. approved, and is available in 60-, 100-, 150-, 200-, 300-watt sizes for any of the manufacturer's incandescent boxes.

Atlas Electric Products Co., 319 Ten Eyck St., Brooklyn 6, N. Y.



Installation of nonmetallic-sheathed cable has been made easier by a smoother, cleaner surface on Anaconda's new Silver Dutrax. The new cable strips easily. The uniformly-small diameter makes it good for wiring in existing building. Silver Dutrax Type NM is available in twin-conductor in sizes Nos. 14 to 8 AWG and in 3-conductor round, in sizes Nos. 14 to 6 AWG. Standard lengths are 250-foot coils for sizes Nos. 14, 12, and 10, and 125-foot coils for sizes Nos. 8 and 6 AWG.

Anaconda Wire & Cable Co., Hastings-on-Hudson, N. Y.



Capacitor Equipment

(11)

assembled capacitor Completely equipments ready for installation on secondary network systems are available. Apparatus is especially applicable for use on urban distribution systems where there is air-conditioning and other low power factor equipment. Capacitor units are standard outdoor type, rated at 131 kvar at 216 volts. Assembled equipments are available for 40, 80, and 120 kvar, 3-phase. Modular-type construction permits them to be stacked three high, or otherwise arranged to fit available vault space. Equipment is completely submersible. Enclosed current-limiting fuses are terminal mounted. Capacitor units are zinc sprayed and frame is galvanized.

Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.



Fluorescent Starters

(12)

A new line of fluorescent lamp starters, pushbutton and automatic reset types, named "Gold-Tone". These double-duty starters are encased in a gold anodized can as a safeguard against corrosion. Starters are UL approved and ETL certified. Component parts of both pushbutton reset and automatic reset starters include precision glow tube and condenser. Construction and design give high starting speed under adverse weather and humidity conditions. Pushbutton reset automatically cuts a defective lamp out of the circuit. On replacement the lamp is reactivated by pressing a button at the top of the can. Literature is available.

Lustra Corporation of America, 36 Washington St., Brooklyn 1, N. Y.

THOUSANDS OF PLANTS NOW GETTING THOUSANDS OF SPEEDS



Miracle Motor ANY RPM BY DIAL CONTROL

Get more production out of your present machines by powering them with U. S. Varidrive motors. No extra space required. Thousands of plants are profiting with this miracle motor. Turning a simple control handle changes speed of the Varidrive to any desired r.p.m. in ratios up to 10:1. Operators can instantly select the speed best suited for the work.

ALL-IN-ONE PACKAGE

Occupies little more space than a single speed motor. 1/4 to 50 hp, 2 to 10,000 r.p.m.

VARIDRIVE Mail Coupon for New 16-pg. Booklet REQUEST FOR VARIDRIVE BOOKLET

U. S. ELECTRICAL MOTORS Inc. ECM-4 Box 2058, Los Angeles 54, Calif. or Milford, Con							
Name							
Company							
Address							
City	Zone	State					

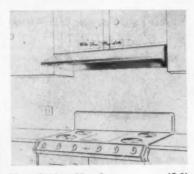


Watthour Meter

(13)

A new 50-ampere, single-phase watthour meter of improved design and straight-line accuracy up to 200 amperes. It is designed to meter loads on highly-electrified homes or farms. It has a load range more than three times that of the standard 15-ampere 1-50 meter, with no increase in external dimensions. In construction of the "S" meter version of the 50-ampere unit, a new molded base allows for larger terminal blades and is strengthened to withstand the greater forces required for insertion in a heavy-duty socket. A low temperature rise is maintained in socket-type meters by utilization of heavy-duty current leads and windings with silver-plated terminal blades.

General Electric Co., Schenectady 5, N. Y.



Ventilating Hoods

(14)

Kitchen ventilating hoods consist of fan, light and hood combination. Exhaust fan is a Model 209 Blo-Fan and light is a 100-watt Pry-Lite recessed fixture. Both are wall switch operated. Hood is 42 inches wide to fit standard cabinets and requires 4½ inches above bottom cabinet shelf. It is finished in Dupont Dulux white or copper-toned enamel. For cleaning, two thumb screws loosen by hand to lower entire hood. If desired, the hood can be lifted off for cleaning outdoors, although fan and light remain in cabinet.

Pryne and Company, Pomona, Calif.

Weatherproof Wire

(15)

A new type of weatherproof wire, in which the outer braid is glass yarn. It is available in triple knit weatherproof wire in sizes No. 14 through 4 AWG. Glass outer braid is resistant to moisture, heat, chemical action, and abrasion. Glass yarns have a tensile strength several times higher than comparable organic fibers.

Rome Cable Corp., Rome, N. Y.



Window Fans

(16)

A new line of window fans in seven sizes, complete with two-speed motor, switch, cord and plug, ready for operation. Sizes 12-, 16-, 20-, 24- and 30-in. are available with both two-speed exhaust and two-speed electrically reversible. Sizes 12-, 16- and 20-in. have adjustable side panels, while 24- and 30-in. are available with fixed side panels. Fans will fit all standard windows. They have Underwriters' approval. All fans have a mist gray fine. Chelsea Fan & Blower Co. Inc. 639

Chelsea Fan & Blower Co., Inc., 639 South Ave., Plainfield, N. J.



Plug and Receptacle

(17)

A new rapid disconnect power plug and receptacle, Nos. 20295-1 and 20296, for use on tractors, trucks, busses, stationary engines, oil field, heavy industrial marine or ordnance equipment, or any other portable or stationary prime power sources. Fittings carry two 200-ampere contacts for No. 0 cable with 110 volt to 440 volt service. Cable entry is water-tight sealed with a screw-tightened clamp. Steel parts are cadmium plated to resist corrosion. Spring-actuated snap covers protect both plug and receptacle automatically when not in use. Bulletin PR-GBI is available.

Cannon Electric Company, 3209 Humboldt St., Los Angeles 31, Calif.



Modern Low-Cost Circuit Protection

The new Cutler-Hammer Unit Breaker—the Unit System Circuit Protector—has everything you want—low price, top convenience in stocking, in selecting proper circuit breaker capacities for a specific home or other buildings, rapid, easy installation and wall-switch snap-on, to restore service.

The Cutler-Hammer Unit Breaker is 3 simple components. The case with bus bar assembly. The individual circuit breaker in 15, 20, 30, 40 and 50 amp. capacities that the contractor just picks out and pushes in. And the cover for flush or surface mounting. 6 case sizes handle any circuit combination from 1 to 32 circuits. There are many other features too—plus genuine Cutler-Hammer quality at new low prices.

See this new Unit System Circuit Protector. Get the whole story including the new pocket size Handilog and selector charts. Don't delay. Cash in. Contractors, see your authorized Cutler-Hammer distributor today. CUTLER-HAMMER, Inc., 1306 W. St. Paul Avenue, Milwaukee 1, Wisconsin.





"G-E STARTERS ARE EASIEST

EASY MOUNTING. Three screws on the back of the enclosure hold the scarter in place. To mount the starter just slide the slotted openings over the screws. The starter is then supported while you tighten the screws, which are easily accessible from the front. The same type mounting can be used for mounting the enclosure.

CLAMP-TYPE TER-MINALS. Solderless clamp-type terminals are easy to reach from the front. Wiring to the terminals is simplified as the terminal clamps ride out on screws. Just slide the stripped down wire under the terminal clamp and tighten down the screw.

PROTECTED COIL.
Starter coil is protected from acrewdriver slips during installation. The strong box coil, completely enclosed in plastic, won't let accidental blows, dust or moisture get at the coil.

PANHEAD SCREWS.
Large-size panhead screws on all terminals make it easy to get a tight fit. Wide, deep slot and a hardened head take full screwdriver width, and prevent burring or screwdriver slippage.

COMPLETELY FRONT WIRED. All wiring, including the inter-lock and overload relays, is easily done from the front. The screwdriver goes straight into the clamp-type terminals which are completely free for your wiring since all factory wiring is to separate terminals.

TO INSTALL"

Says Gordon Smith, President of Gordon Smith and Company, Inc., Bowling Green, Kentucky

Gordon Smith and Co., Inc., manufacturer of engine and electrically driven air compressors, has standardized on G-E magnetic starters because they are reliable and easy to install. Customer satisfaction has "sold" this company on G-E starters.

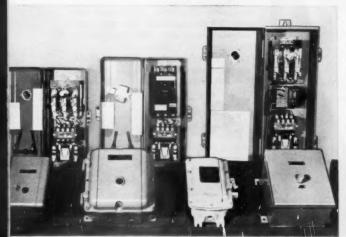
ADDITIONAL FEATURES of the magnetic starter that contribute to easy installation and reliability are knockouts in the top, back, sides and bottom of the enclosure; a permanent air gap that prevents contacts from "sticking-in"; bi-metallic overload relays that are easily adjusted for manual or automatic reset.

FOR MORE INFORMATION contact your nearest G-E Sales Office, or Distributor, or write Section 730-52, General Electric Company, Schenectady 5, N. Y.



"WE'VE NEVER HAD A CUSTOMER COMPLAINT DUE TO STARTER FAILURE," says Gordon Smith. This customer satisfaction has come from the reliable operation, ease of inspection and maintenance, and long life of General Electric magnetic starters.

FOR EVERY MOTOR-STARTING APPLICATION - A G-E MAGNETIC STARTER



NO MATTER WHAT YOUR REQUIREMENTS, you can get a G-E starter to fit your application. The complete line of enclosures includes standard, watertight, dust-tight, explosion-proof and



semidust-tight. Enclosures that meet JIC specifications are also available. Full voltage starters rated up to 200 amperes are available in NEMA sizes 00, 0, 1, 2, 3, 4 and 5.

CHOOSE FROM THE COMPLETE GENERAL-PURPOSE CONTROL LINE















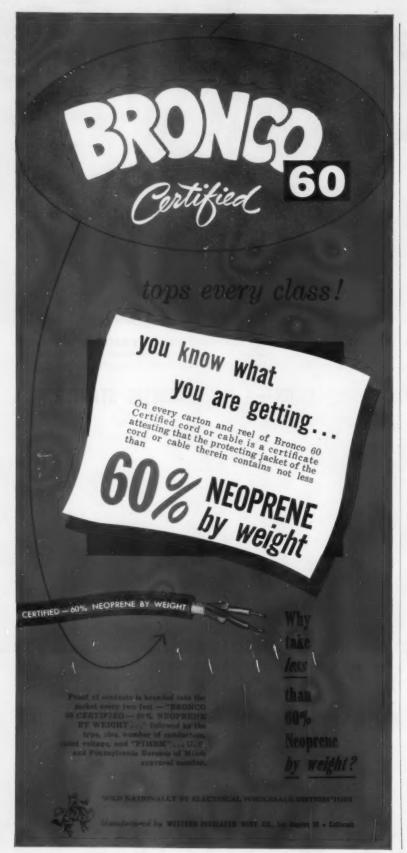


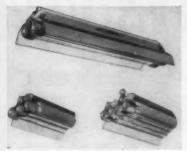
MANUAL STARTERS — MAGNETIC STARTERS — PUSH BUTTONS — COMBINATION STARTERS — RELAYS — REDUCED VOLTAGE STARTERS — SOLENOIDS — LIMIT SWITCHES

GENERAL



ELECTRIC



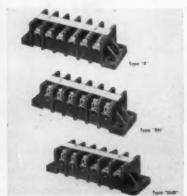


Fluorescent Fixtures

(18)

A new line of "EFU" explosionproof fluorescent fixtures for use in hazardous locations: Class I, Groups C and D; Class II, Groups E, F, and G. They include 2, 3 and 4-lamp designs for both straight and angle mounting, and offer a choice of three different ballasts: (1) bi-pin "Pre-Heat"; (2) single-pin "Slimline"; (3) and a new bi-pin "Rapid-Start" ballast. Fixtures permit re-lamping from either end. They may be installed in a continuous row, end to end, and conform to N.E.C. standards when used with appropriate fittings. Designed for use with 40-watt, 48-inch, T-12 and 100watt, 60-inch, T-17 fluorescent lamps, fixtures are factory sealed. Line connections are made to a terminal block in junction chamber. End housings are cast aluminum. Reflectors are steel, white enameled inside with grey exterior, and may be removed for

Appleton Electric Co., 1701-59 Wellington Ave., Chicago 13, Ill.



Terminal Block

(19)

A new high-current terminal block, known as Series "R", will be available in three types, namely: Type "R", rated 35 amperes, 750 volts with No. 10 brass washerhead terminal screws for wire up to No. 10 AWG; Type "RH", rated 50 amperes, 750 volts with high-pressure solderless connector for wire from No. 8 to No. 18 AWG; and Type "RHR", consisting of any combination of Types "R" and "RH"

in the same block. Series reatures interchangeability with other standard high-current blocks on the market. Blocks measure $1\frac{7}{8}$ -in. wide, with terminals spaced on standard $\frac{5}{8}$ -in. centers. Also featured is the universal 3-hole mounting brackets integrally molded with end partitions. White marker strip is provided for convenient circuit identification.

Curtis Development & Manufacturing Co., 3266 North 33d St., Milwaukee 16, Wis.



Electric Motors

(20)

New Klosd normal-speed electric motors, in frame sizes 182 and 185. These smaller motors incorporate new NEMA approved standards. Some of the features are more hp in less space; new terminal boxes; greater bearing protection; protected construction and improved insulation. Windings are protected with a heat-resistant baked varnish and moisture-resistant sealer.

Sterling Electric Motors, Inc., 5401 Telegraph Rd., Los Angeles 22, Calif.

Magnet Wire (21

A new silicone enameled magnet wire intended for use in electrical equipment operating at "hottest spot" temperatures of at least 130 deg. C. The wire has good abrasion resistance, adheres to conductor, is smooth and is not attacked by common solvents. The enamel will not craze when exposed to solvents, and will not crack when subjected to extremely low temperatures (minus 65 deg C.). Dielectric strength is 1500 volts per mil. Best results in windings will be obtained by using Silicone-treated Fiberglas insulators and Silicone varnishes. Wires insulated with new enamel are furnished in single and heavy grades, in dimensions as given in catalog for Formvar and nylon. Film is removed by "chemical strippers". Color is reddish brown on thin-film wires; darker colored in heavier grades.

Anaconda Wire & Cable Co., Muskegon, Mich.

For Trouble-Free Conduit Threading...it's a 65R



You won't find a die stock to equal this popular 65R—anywhere! It saves time—one set of self-contained high-speed dies adjust to 1", 1¼", 1½" or 2" pipe or conduit in 10 seconds! Mistake-proof self-centering workholder sets to size instantly! It saves trouble—lead screw won't jam, it kicks out automatically when standard length thread is cut. Clean perfect threads, fast! For trouble-free extra-easy threading buy 65R at your Supply House.

THE RIDGE TOOL COMPANY . ELYRIA, OHIO, U.S.A.





Designed Specifically to Save Time, Labor, and Money for

ELECTRICAL -- CONTRACTORS ----

Now - with the addition of the new Upper Structure to Morrison's complete line of service accessories — you can equip your truck with a Morrison Carry-All Service Body which gives you all these advantages:

- · Six Lockable Weathertight Compartments
- Totally Enclosed, Lockable Body
- Positive Protection for tools and supplies
- What you Need . . . When you Need It . . . Where you Need It . . . for Every Job
- · Extra Cubic Feet of space for Large, Bulky Material
- Protected Working Area
- · Six Extra Shelves Inside Upper Structure
- Models to Fit Any 1/2, 3/4 or 1-ton Chassis
- Complete line of Accessories for your

---- WRITE TODAY!-

-for all the facts on how the Morrison Carry-All Service Body with the new Upper Structure can pay for itself in on-the-job savings in time and labor.

MORRISON STEEL PRODUCTS, INC. 683 Amherst Street, Buffalo 7, N.Y.
683 Amherst Street, Buffalo 7, N.Y.
I'd like all the facts about Carry-All Bodie including cost and where I can buy them
Name Title
Firm
Street
City Zone State
Also Manufacturers of MOR-SUN Furnaces an

Literature on request.



Lighting Fixture

A new explosion-proof lighting fix-

(22)

ture with prismatic Holophane reflector allows industrial or laboratory technicians to perform highly detailed tasks without eye-strain at hazardous locations. When equipped with an "inside frosted" 5900-lumen, 300-watt lamp, the new EV series lighting fixture delivers a total light efficiency of 72.3%. Most light rays striking reflector's surface are refracted directly downward to work area. Lighting fixture's lamp and wiring compartments are individually explosion-proof. Its cast aluminum construction can resist innumerable internal explosions without damage and its flame-tight threaded joints, prevent escape of flames or gases into outer atmosphere.

Crouse-Hinds Company, 7th North St., Syracuse, N. Y.



Fluorescent Tube

(24)

Glo-Tone, a new 40-watt fluorescent tube, developed especially for "soft effect lighting" in hotels, restaurants, beauty-salons, cafes, florist and apparel shops, etc. Available in all popular wattages, emits a warm peach-colored light. Soft tonal quality of lamp is flattering to complexion. Each lamp is guaranteed for two years of burning life.

work. A twist of the male tap quickly disengages it. Known as catalog No. 1710-RS, the cover is made of 19-gage steel, measures 4½ by 2½ inches, and is supplied with two Surfaceduct mount-

ing bridges and mounting screws. It has a gray baked enamel finish. National Electric Products Corp., Gateway Center, Pittsburgh, Pa.

LUSTRA

40 L W

Lustra Corporation of America, 36 Washington St., Brooklyn 1, N. Y.



Adapter Cover

A raised adapter cover designed to accept the Ever-Lok receptacle device without the installation of separate boxes. The new cover, which snaps on Surfaceduct raceway like standard capping, permits installation of receptacle device within body of duct. Although designed specifically for the 20-amp R & S Ever-Lok receptacle, the cover also will accommodate various other large-bodied devices. The use of the Ever-Lok device assures permanent, secure lock of male tap to receptacle, thus preventing accidental disconnection of tools in continuous production



Limit Switch

This new heavy-duty limit switch, Class 9007 Type T, gives 11 arrangements in one. A variety of operating lever arms are available which can be mounted in any angular position. Diecast enclosures are gasketed with neoprene, making them watertight, oiltight and dusttight. Seven varieties of baseplates, as well as threaded holes in the side of the diecast box, permit mounting in a number of positions. Bulletin SM-239 is available.

Square D Company, 4041 N. Richards St., Milwaukee 12, Wis.



How lighting helps lure travelers to this luggage store

Every retailer has the problem of attracting more customers in order to sell more merchandise.

Here's an example of how Corning engineered lighting helped solve that problem for Carey's Luggage Store, Elmira, N. Y.

Carey's needed lighting that would be decorative as well as efficient. That's why Alba-Lite was selected. And you can see how well Alba-Lite fills the assignment.

Smithcraft Area Illumination, utilizing large panels of Alba-Lite, provides 100 f.c. of evenly diffused, glare-free and shadow-free light. Merchandise is presented to

customers in its rich, sales appealing best. That's because Alba-Lite transmits the true color of the light source. Fixture efficiency is high—yet panel brightness is low.

And the lighting and decorative advantages Carey's is enjoying to-day will never diminish. Alba-Lite won't fade or discolor or warp with age or atmosphere. Its smooth surface is easy to clean. It keeps its new look.

Use Lenslites for Emphasis

PYREX brand Lenslites with 150watt lamps and mounted in Litecraft fixtures focus attention on gift and decorative items. The illumination level on counters beneath the downlights is 200 f.c. and on the display shelves it is 100 f.c. Two center Rambush ceiling downlights draw buyers to items in the showcase below . . . boost profitable impulse sales.

You can achieve equally effective results with Corning engineered lighting for schools, hospitals, offices . . . in just about every lighting project that comes your way. For additional information, write for the new Architects and Engineers Handbook. It's filled with helpful and useful information. Send the coupon today.



CORNING GLASS WORKS
CORNING, NEW YORK

Corning means research in Glass

CORNING	GLASS	WORKS,	Dept.	EC-4,	Corning,	N.	Y.
Plagra sand	ma =	of the now	Architecte	and I	Engineers He	ndh	201

Name.....Title....

Firm.....

Address



Guth Magic-lite*

with GRATELITE** Louver Diffuser

the magic combination of architectural beauty and sales-building lighting for contemporary store interiors.

GUTH MAGIC-LITE is well-shielded by a GRATELITE Louver-Diffuser. It transforms the direct light into softly flattering illumination, essential for good merchandising.

LOW ORIGINAL COST-LOW UPKEEP COST

Uses least expensive lamps—GrateLite Louvers are cleaned in 2 minutes.

VERSATILE

Mount singly or in patterns. Recess or surface. 24" or 12" square sizes.

May we send you our new Magic-lite Catalog 901-A?

THE EDWIN F. GUTH CO. ST. LOUIS 3, WO.



Instruments

(26)

A new line of miniature portable de instruments which incorporate a self-shielded mechanism. Known as Model 281, instruments employ the Weston core magnet mechanism which provides such excellent shielding that the magnetic field created by a conductor carrying 15,000 amperes at a distance of 3 ft. from an instrument causes a temporary error in indication of less than 1%. They are available in a wide variety of ranges in single and multi-range voltmeters, ammeters, and volt-ammeters. It measures approximately 4½ by 4½ inches.

Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.



Circuit Breakers

(27)

A new XO switched neutral circuit breaker which enables the customer to use standard XO circuit breaker load centers in complying with the latest N.E.C. rulings for circuits to gasoline and dispensing pumps and overcurrent devices in permanently grounded conductors. Paragraph 5120 E requires a disconnect in all conductors supplying equipment in or on a hazardous area dispensing pump. Paragraph 2409 restricts the use of overcurrent devices in permanently grounded conductors. The neutral circuit is switched (paragraph 5120 E) by one pole of the XO breaker which does not have overload elements (paragraph 2409). The line side ground connection is made

196

**U.S. & Can. Pats. Pend.

by a flexible pigtail connecting the contacts to the standard load center neutral. Underwriters approved XO breaker may be combined with other standard XO breakers for lighting or general duty circuits in conventional XO load centers.

Square D Company, 6060 Rivard St., Detroit 11, Mich.



Reel

(28)

Series 1,000 dual-action reel for use on extensible electric lighting fixtures, otherwise known as the pull-up-and-down type. Reels will accommodate either two or three conductor cords and have a lifting capacity of up to five pounds and a travel of approximately 3½ feet. They are equipped with patented latching arrangement which latches cord at desired length.

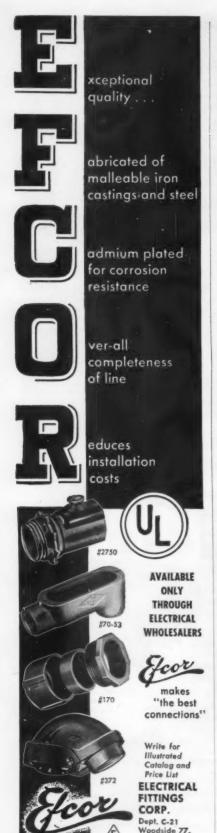
Benjamin Reel Products, Inc., 10700 Broadway, Cleveland 25, Ohio.

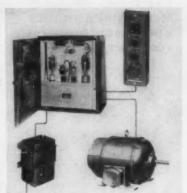
Maintenance Equipment (29)

A luminous ceiling system has been developed that can be rolled up in 3-foot width sections of up to 25-foot lengths and run through a special washing machine. Machine comprises three baths. First, wash and scrub, thermostatically held at 100°F; second, cold water rinse; third, solution to distaticize. The corrugated thin Lumi-Plastic is fed through automatically and can be replaced in ceiling at once. Catalog available.

Luminous Ceilings Inc., 2500 W. North Ave., Chicago 47, Ill.





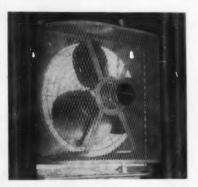


Drive

(30)

A new stepless adjustable-speed drive, the electronic Select-A-Spede, designed for operation from ac power lines and available with dc drive motors in standard NEMA frame sizes, 1 to 15 hp. Advantages are precision speed control; wide speed range where required; adaptability to a variety of optional electrical and mechanical modifications; and use of new, simple electronic circuits. Unit is built with speed ranges of 5:1, 20:1, or 50:1, with 100:1 available for some applications. Complete unit consists of an anode transformer, electronic control panel, pushbutton station, and a specially designed adjustable-speed dc drive motor. Anode transformer and control panel may be mounted in any convenient location, with drive motor and pushbutton station available in any desired enclosure -open, drip-proof, splash-proof, totally enclosed, or explosion-proof. Bulletin No. 1500 is available.

Louis Allis Co., Milwaukee 7, Wis.



Window Fan

New York

(31)

A reversible window fan that can be set at any angle for draft-free home Model RS20 features a cooling. special patented swing-around mounting which permits focusing of the air stream in any direction 0° to 180°. Fan cabinet can be pivoted from inward circulating position to outward exhausting position without removing either fan unit or window screen. Both sides of fan are protected by grilles. The three 20-inch cloverleaf blades are driven by a 1/10 hp two-speed motor, moving 3500 CFM at high speed, 2500 CFM at low speed. It is 22½ in. high and 24 in. wide. Expandable metal wings permit installation in windows up to 44 inches wide.

Fan Division, International Oil Burner Co., 3800 Park Ave., St. Louis 10. Mo.



Floodlight

(32)

The No. 7140, 300-500-watt and the No. 7190, 750-1000-watt lines of floodlights have been redesigned using a one piece aluminum housing casting. They are completely weatherproof. Wire enters through a squeeze bushing. The narrow beam floodlights have a focusing mechanism. Available with clamp or five spring toggle hinged rings with clear, stippled, or ribbed lens for maximum light control. Crossarm pole top, flat base and clamp mountings available.

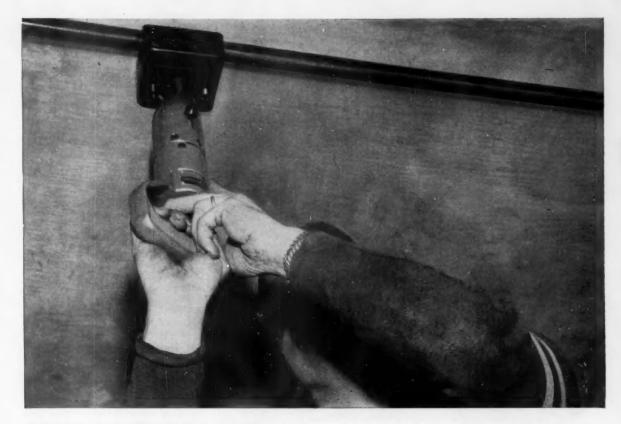
Revere Electric Mfg. Company, 6009-17 Broadway, Chicago 40, Ill.



Cable

(33)

New Type UF (underground feeder) electrical cable, suitable for use on farms and in rural areas. Called "Nepconol" Type UF cable, it is said to be the most economical cable for direct burial underground. Available in single conductor in sizes 14 through 4, the standard color is black. In two-conductor, with or without ground wire, and three-conductor, it is available in sizes 14 through 10 for branch circuit and



Save Up to 80% on Fastening Costs with the **REMINGTON STUD DRIVER**

"Cuts my conduit anchoring cost by an average of 74%"—writes one electrician about his Remington Stud Driver, and it's a typical report. With a speed of up to 5 studs per minute, this powder-actuated tool is bringing new economy to the job . . . new opportunities for electrical contractors.

Many contractors say they can bid lower, get more jobs with the Remington Stud Driver. Others tell us that the tool's light weight-6 lbs.-makes overhead work a lot easier. All are agreed that you can't beat the Stud Driver for setting studs in concrete and steel.

What's your fastening job? Whether you're fastening eye bolts for stringing wires or conduit clips to concrete, you'll save money with the Remington Stud Driver. For further information on how this amazing tool can help solve your fastening problems, mail the coupon at right.

"If It's Remington—It's Right!"



Listed & Approved by Underwriters' Laboratories, Inc.

QUESTIONS YOU ARE ASKING

QUESTION:

Where can I get information about the guards that many electrical contractors have been using for special applications?

ANSWER:

Just send the coupon below; we'll be glad to supply you with a description of all the guards and their uses.

MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. ECM-4 Remington Arms Company, Inc. Bridgeport 2, Connecticut

Please send me free copies of the new booklets showing how I can cut my fastening costs. Name,

Position_

Address

Balder Baltrico Motors

NEW NEMA Re-rated FRAMES

Now in Production The new BALDOR Baltric motors—smaller NEMA frames • more horsepower • less weight • streamcooled • totally enclosed • high performance • cool operation • simple design • compact contour rugged construction • protected ball-bearings • polyphase and single phase • integral and fractional ratings.



★ MAY WE SEND YOU
BULLETIN 400

BALDOR BALTRIC MOTOR

BALDOR ELECTRIC CO.

4353 DUNCAN AVE., ST. LOUIS 10, MO-

BALDOR ELECTRIC COMPANY . ST. LOUIS 10, MO.

Balder

TOTALLY ENCLOSED

STREAMCOOLED MOTORS

REQUIRE Less SERVICING

BALDOR STREAMCOOLED Motors are solidly enclosed, cooled by an outer-mounted fan in the bell-end. They cannot inhale dust, dirt, grit or metal particles. They require no dismantling for cleaning thus LESS servicing—no interruption of production.



Other features of BALDOR Motors include sealed ball-bearings which can be re-lubricated without removing end-plates. Corrosion-resistant inside and out. End plates interchangeable for vertical or bracket mounting. Each motor individually dynamically balanced. Standard NEMA dimensions.

BALDOR ELECTRIC CO.

4353 DUNCAN AVE., ST. LOUIS 10, MO-

BALDOR ELECTRIC COMPANY . ST. LOUIS 10, MO.

feeder services; standard color is ivory. It is impervious to all elements in the soil and is resistant to moisture of any kind, to acids, and to oils. Thermoplastic is used as insulation for the conductors and as a jacket for the cable. Cable is strengthened by fibre glass members which separate the conductor insulation from cable jacket. It has Underwriters' Laboratories approval.

National Electric Products Corporation, Gateway Center, Pittsburgh, Pa.



Bar Hanger

(34)

A new adjustable bar hanger has been announced. Adjustment is obtained by a telescopic action of the two halves of the hanger similar to the action of an adjustable curtain rod. Raco clip secures box to the bar without interfering with device space in box. It also provides added wiring room in multiple device boxes. Bars are available in two styles, clip bars and stud bars. Each bar style comes in two sizes to fit various studding spacings. They fit all sizes of furring and studdings from 1 in, by 2 in, to 2 in, by 4 in, and all sizes of joists and rafters. Other advantages are electrogalvanized finish; flanges automatically locate box at proper depth for plaster walls and dry walls.

Raco Division, All-Steel Equipment, Inc., Aurora, Ill.

Plugs

(35)

An armored connector, Part No. 920, which meets all the requirements of the tri-service Specification MIL-C-3767 is available. Plug consists of APM's standard U-120/U armored power plug, to which a removable 3rd blade (for grounding) has been added. It is approved for use with both 2- and 3-bladed receptacles. It may be used directly in grounding receptacles with the 3rd blade in position. Or, where grounding receptacles have not yet been provided, the 3rd blade can be removed. In addition, the 3rd blade can be purchased individually, for adding to APM Plug No. 921 at a later date, when the grounding receptacles



will be an electrical standard. Model No. 920 plugs will accept cables from 25-in. to .450-in. in diameters. Ratings are 125-volt, 15 amperes to 250-volt, 10 amperes. Bulletin No. PL-2 is available.

Automatic & Precision Manufacturing Co., 252 Hawthorne Ave., Yonkers 5, N. Y.

Floodlight

(36)

A new R-40 weatherproof flood-lamp made of weatherproof glass to resist cracking due to sudden temperature changes and moisture. It can be used indoors or outdoors without enclosed fixtures. A pure silver reflector is sealed inside lamp. Base is nickel-plated to prevent "freezing" in socket. Available in standard voltage 300- and 500-watt lamps with mogul bases. The 300-watt LS-Flood is also made with a medium sockets. Bulletin 14 is available.

Radiant Lamp Corp., 300 Jelliff Ave., Newark 8, N. J.



Wiring Devices

(37)

A complete line of locking type caps, receptacles and cord connectors, named Ley-O-Lock, are available in over 40



MORE TIME-SAVING installation features

- Sidewall fans packed complete in one carton. Outside housing slides out for installation—nothing to disassemble.
- Ceiling fans packed complete in one carton. Inside housing immediately available for preliminary installation. Carton includes motor, blade and grill in smaller carton.
- Motor and blade mounted on one bracket installs by merely tightening two wing nuts.
- All fans equipped with extra long "Break Off" bolts. Enables installer to compensate for wall or ceiling irregularities requiring longer or shorter bolt.
- Grills removable by merely unscrewing center grill knob—no tools required.
- 11 models to choose from.
- Full 5 year guarantee on all models.

For complete information and catalog write to

BERNS MFG. CORPORATION 3050 N. Rockwell St. • Chicago 18, III.



"KF" SERIES Wall switch or pull chain models. All models adjustable and are available for all wall thicknesses . . . 590 C.F.M. or 800 C.F.M.



"WF" SERIES Economical models, fully automatic with wall switch control. "Flutter-free" counter balanced shutter in 'outside hood. Also available with pull chain. All models adjustable . . . available for all wall thicknesses. 475 C.F.M. or 600 C.F.M. at fan discharge.



"TC" SERIES Exhaust through ceiling for truly conomical installation. "Reducer" incorporates counter-balanced, automatic shutter. Adjusting hangers permit easy adjustment of housing to desired distance below joists. 525 C.F.M. or 750 C.F.M. at fan discharge.



Don't gamble against a ground on an energized power circuit. It can cause a costly production shutdown tomorrow. Only the Bruat Faultfinder can make sure it won't happen. Country's largest manufacturers depend on it. Price \$450, express prepaid.

PRINCIPAL FEATURES

- · Imposes only 2 amperes on
- Can be used in dark or noisy locations.
- No pulling of switches or interference with production.
- Locates faults on ungrounded wiring systems up to 550 velts, a.c. or d.c.
- Traces pole line signals without climbing.
- Combination ground detector and fault locator.
- and raust locator.
- Equally strong signal on open or enclosed wiring.
- No delicate meters or instruments to adjust.
- · Compact, durable—easy one-
- Phase indicator lights visible at distance.
- SEND ORDER TODAY

SEND FOR THIS NEW





48 Austin St. NEWARK 5, N. J.

different units, in two, three and four conductors. Devices are used wherever vibration or shock might loosen connections, such as portable power tools, and most office and industrial machines and appliances. Features include larger terminal screws, double contacts of heavy phosphor bronze, and extra heavy phenolic housings. Brochure is available.

Leviton Manufacturing Co., 236 Greenpoint Ave., Brooklyn 22, N. Y.



Protected Motors (38)

A new line of heavy-duty, protected induction motors includes standard drip-proof protected, totally-enclosed fan-cooled, totally-enclosed fan-cooled explosion-proof, and totally-enclosed non-ventilated explosion-proof units. These standard-NEMA-frame-size motors range from ½ hp to 125 hp. They can be installed anywhere in any climate: outdoors without a cover; in damp areas; in dusty or corrosive environments; in normal service surroundings where condensation is always a hazard. All motors are completely weatherproofed. The explosien-proof motors are Underwriters' approved for Class I, Group D; Class II, Group F; and Class II, Group G hazardous locations.

The Electric Products Co., 1725 Clarkstone Road, Cleveland 12, Ohio.

Air Conditioning (39)

A new line of self-contained air conditioning units with air-cooled condensers has been designed for residential applications. These new units find particular application as a type of air conditioning which has performance characteristics that lie between conventional room cooling and central system cooling. The units can be used to cool the complete interior of small houses or the most used living space of any residence. They can be installed in the basement, attic or utility room; can be used in conjunction with ductwork for forced air heating systems, with their own ductwork, with a plenum space or without external distribution ducts altogether. Available in 1-, 1½- and 2-hp sizes, the units can be used to cool a wide variety of room groups. They require no piping; need only the proper size electrical circuit to handle the current requirements.

Remington Air Conditioning, Div. of Remington Corp., Auburn, N. Y.



Electric Heater

(40)

A new electric heater which can be mounted on concrete, brick or stone walls. Known as Electromode surface mounted wall heater, it is for use in basement game room, laundry, garage, office, or any room with hard surface walls. Clean, fan-forced heat is circulated at floor level and the patented, cast-aluminum, sealed-in heating element eliminates any danger of fire, shock or burn. It is available in 1500-, 2000-, 3000- and 4000-watt capacities, in both automatic and non-automatic models. Three "T" slots are provided on back of heater for surface mounting. It measures 21-in. high, 17-in. wide and extends 5½-in, from the wall.

Electromode Corporation, Rochester

Product Briefs

(41) The Ace Co., Ocala, Fla., has announced a new, improved portable electric blower.... (42) A new type of Varley battery for lift trucks, mine locomotives and other heavy-duty industrial uses is available from the Battery Division, Chicago Forging & Mfg. Co., Chicago, Ill.... (43) Multi-Matic Corporation, Van Nuys, Calif., has added two new super Hole-A-Matic models to its line of diggers.

(44) Carboloy Department of General Electric Company, Detroit, Mich., reports that its new cemented carbide grade 370 for heavy duty steelcutting is now available in a wide range of standard, stocked blanks. . . (45) A portable electric metal-cutting band saw has been introduced by the Porter-Cable Machine Company, Syracuse, N. Y. . . . (46) Cornish Wire Co., New York,

NEW REVOLUTIONARY THIRD RAIL SYSTEM

Rail Moves . . . Contact Posts Stationary

Here's the first safe distributed contact system for electric traveling cranes and heavy haulage equipment. Posts are energized when rail comes in contact . . . when rail leaves contact with post, that post is de-energized immediately and contact shoes become dead. This new Keystone Distributed Contact System offers these exclusive advantages:

PERMITS GREATER MOVEMENT of men and materials. No fence obstructions. Widely spaced contact posts fed from conduit.

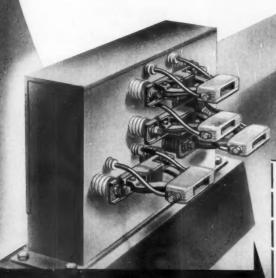
MAXIMUM SAFETY . . . no complicated systems. All posts de-energized except when in contact with rail.

FEWER MAINTENANCE SHUTDOWNS . . . maintenance can be handled while equipment is operating.

LESS TIME LOST due to weather. System can be cleared easily.

SIMPLIFIED INSTALLATION made possible by completely wired assemblies. Operates with AC or DC current.

ELECTRIC SERVICE MANUFACTURING CO.



Send for FREE Engineering Data Book



Electric Service Manufacturing Co. Philadelphia 32, Pa.

Please send me the free data book on KEYSTONE Distributed Contact (Third-Rail) System without obligation.

NAME.

COMPANY_

ADDRESS

STATE_

NOV...you can use genuine SANGAMO QUALITY Time Switches for all of your jobs!

At last you can use a really top quality time switch that will assure satisfactory performance on every installation—even those that call for the least expensive equipment. The new Sangamo Type B Time Switch, that costs only a fraction more than the very lowest priced time switch, puts Sangamo Quality within the reach of all.

It's rated at 30 amperes, and will open an entirely new range of applications for single-pole single-throw time switches.

Get this sensational value at your electrical wholesaler's today—try the new low priced time switch that will wipe out the service call headache and the need for defective switch replacement.



STURDY ALL-STEEL CASE

The new Type B is enclosed in an attractive all-steel case with a hinged cover that can't be misplaced and a sealable hasp for protection against tampering. There is no glass window to break accidentally. Overall dimensions— $7\frac{1}{4}$ " high, $4\frac{1}{4}$ " wide, and $3\frac{1}{8}$ " deep.



PLENTY OF WIRING ROOM

Type B is a cinch to install! Almost one half of the inside space available for speedy wiring, four convenient $\frac{1}{2}$ "— $\frac{3}{4}$ " multiple knockouts and a keyhole slot in the back permit neat, fast, labor-saving installation.



SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

30 AMP. RATING

Single-Pole Single-Throw

can be hand tripped without disturbing

DEAD FRONT SAFETY

dental shocks.

lating shield that eliminates exposed

wiring and exposed contacts gives pro-

> SANGAMO QUALITY at \$1350 list

Trade Discounts Apply

Sangamo-provinging mechan runs quietly and c ciently and requ

EVERYTHING YOU'VE BEEN WANTING

in a low-priced switch!

Type B truly represents well-known Sangamo Time Switch Quality. It is powered by the same now speed motor that powers Sangamo heavy-duty time switches. It is built with the same Sangamo precision that assures dependability, accuracy, and long lasting

troublefree performance, And, it earries the sem liberal 18 month guarantee that backs any othe Sangamo Time Switch, Give yourself—and your customers—a break by take the Type B on all job where price must be considered.



heavy-duty fans for

double



Every time you install a Signal heavy duty exhaust fan with the extra duty "Stout Heart" Signal motor . . . you've got yourself set up for a double duty profit. Your first profit stays in your "take-home" pocket because Signal fans stay on the job years longer. And their years of care-free service give you extra, double duty profits . . . each installation becomes a demonstration of satisfaction. Insist on Signal, the "stay-sold" fan line! Send for your own copy of Signal's FREE CATALOG today.

STATE HOTE PERF SIGNA

Your customers will see Signal fans pre-sold in

LIFE and THE SATURDAY EVENING POST

FULL YEAR

4 more reasons

why it pays to specify



Signal V-300 series bucket blade, ball-bear-ing exhaust fans: 12", 16" and 18" models. From 500 to 2900 C.F.M. Full Year Guar-



Signal V-500 series panel-type vent fans, 10", 12" and 16" Chal-lenger models. From 350 to 1500 C.F.M. Full Year Guarantee



Signal V-700 series shutter attached vent fans, 8", 10", 12" and 16" models. From 300 to 1600 C.F.M. Full Year



Signal V-520A vent fan, Challenger giant 20" model. From 2100-3300 C.F.M. Full Year Guaral V-520A vent fo



N. Y., has announced the availability of its electric dryer cord set series No. 5533, which utilizes a new molded-on three pole angle rubber plug equipped with "L" shaped grounding blades.

(47) Line Material Company, Milwaukee, Wis., has announced the design and manufacture of new wood guy insulators. . . . (48) The Pengo screw anchor tool is now in production by Petersen Engineering Co., Santa Clara, Calif. . . . (49) Thermador Electrical Mfg. Co., Los Angeles, Calif., has announced a new line of console electric ranges, consisting of five models. . . (50) A new type of ozone generator for use with forced-air heating or cooling systems has been developed by General Ozone Corporation, Chicago,

(51) "Mike-O-Meter" is a new instrument for testing and analyzing any motor capacitor. It is manufactured by the Sprague Products Company, North Adams, Mass. . . . (52) Vernco Corporation, Columbus, Ind., has developed a new line of vacuum fans for horizontal or vertical installation and for residential and commercial use. . . . (53) Mission-Western Engineers, Inc., Pasadena, Calif., has announced two new dynamometers for measuring electric motors of 2-hp and less.

(54) A new, improved PM all-purpose adjustable bar hanger, U. L. approved, has been introduced by PM Electrical Products, Inc., Chicago, Ill. . (55) A redesigned 5 kw output high frequency induction heating unit is offered by Lindberg Engineering Co., Chicago, Ill., for soldering, brazing and light heat treating applications. . . . (56) A new heavy-duty molded phenolic socket with a double-thick, impact-resistant case has been introduced by the McGill Manufacturing Co., Valparaiso,

(57) Anaconda Wire & Cable Co., New York, N. Y., has a new "slipper compound" on its Type TW wire, which is available in sizes from No. 14 AWG to 2,000 MCM. . . . Diamond Power Specialty Corp., Lancaster, Ohio, has developed a new Model 300-BV camera for "Utiliscope" (wired television).... (58) A new 4070 CFM bottom discharge cooler has been added to the evaporative cooler line manufactured by Thermador Electrical Mfg. Co., Los Angeles, Calif. . . . (59) Talk-A-Phone Co., Chicago, Ill., has announced a master selective intercom system for use in large areas and to overcome high noise levels.

(60) Hobby & Brown Electronic Corp., Rockville Centre, N. Y., has developed a new emergency light, known as Model 200 X Sentry-Lite. . . . (61) A new line of Vinyl plastic tapes, called Dutch Brand Vinyl Color Tapes, has been introduced by the Van Cleef Division of Johns-Manville, Chicago, Ill. . . (62) The Acker Drill Co., Inc., Scranton, Pa., has announced a new, medium size, all-purpose digger.

CATALOGS and BULLETINS

- (63) INTERRUPTER SWITCH, type "QB" is described in new booklet showing high speed movie stills of arc interruptions; also results of ice test. Delta-Star Div., H. K. Porter Co.
- (64) Power Supplies for voltage regulation. Five new models are pictured along with complete operating specifications. 8-page bulletin. Allied Engineering Div., Allied International Line.
- (65) PLEXIGLAS FLUORESCENTS for recessed, surface or pendant mounting. "Plexlite" line includes sizes up to 48 inches square and 75-inch diameter round. Folio P-54. Gruber Lighting,
- (66) PIPE MACHINES, power drives and accessories are described in a 16-page catalog giving dimensions, operating capacities and adaptations of the equipment. Featured is a \(\frac{1}{8}\)-in. to 2-in. nipple chuck. Beaver Pipe Tools, Inc.
- (67) CUTOUTS AND ARRESTERS for power control and protection. GEA-1816H, a 16-page bulletin shows ratings and operation of open drop-out fuse cutouts and the unit-combination arrester and cutout. A second bulletin, GEA 1304L, devotes 28 pages to the new Thyrite magne-valve station-type arrester. Application information and a selection guide are provided. General Electric Co.
- (68) ULTRA-SMALL SWITCHES and auxiliary actuators with ratings, dimensions, and available variations are illustrated in 4-page catalog 74. Micro Switch.
- (69) Test Equipment and special industrial controls, both electric and electronic are covered in 193-page catalog 54. Electro-Tech Equipment Co.
- (70) Oven Controls, including pyrometers and thermometers, are described in 2-page bulletin P1262. Bristol Co.
- (71) SILICONE INSULATION materials for high temperature Class H applications. 32-page catalog gives sizes, technical data and suggested procedures for using all types of silicones including varnishes, tapes and compounds. Class H catalog. Insulation Manufacturers Corp.
- (72) TRANSFORMERS. Bulletin S-302A on OISC distribution transformers with built-in surge and overload protection gives data and photographs on







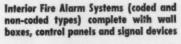


Fire Alarm Systems (Interior & Exterior) You can expect complete reliability from products engineered and manufactured by Signal Engineering & Mfg. Company, originators of A-C Fire Alarm Systems and the Underdome Bell. Some of the SIGNAL products of special interest to the building industry are:



Code Call Systems

al Devices





Single-stroke and vibrating bells in various sizes; chimes, cow bells and horns Write for

Catalogs FSC-3

Code Call Systems for instant communication with individuals away from desks or benches.

SIGNAL

Engineering Representatives in Principal Cities.

ODERNIZE



Water-tight, dust-tight

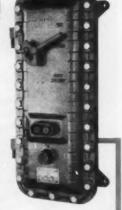
air circuit breaker.

with NELSON motor starters

Plant modernization calls for electrical equipment of improved, up-to-date design.

Nelson motor starters can be furnished with extra interlocks, start-stop push buttons, selector switches, control transformers and other desired components. Special enclosures for watertight, dust-tight and explosionproof service.

Write for bulletins describing Nelson across-the-line, combination, reversing and two-speed starters.



Explosion-proof combine tion starter with air circuit breaker.

NELSON Electric MANUFACTURING CO TULSA. OKLAHOMA

217 N. DETROIT AVE.

TELEPHONE 2-5131

sizes to 100 kva, 14,000 volts. Highvoltage bushing transformers for rural line service are covered in another bulletin, S301A. Ratings through 25 kva and 14,000 volts. Standard Transformer Co.

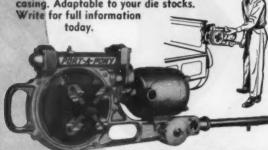
- (73) RUST-PROOF PAINT in a variety of colors and finishes is described in a 19-page catalog. Chemical and heatresistant types also available. Rust-Oleum Corp.
- (74) MILL DRIVES featuring enclosed synchronous mill motors with rubbermill control. Bulletin GEA-5887 discusses advantages of this specialized equipment. 4 pages. General Electric
- (75) ELEVATING TABLE, designated as the "Portelvator," is available in four sizes up to a 5,000 lb capacity unit; has two fixed wheels and two 360° casters for easy handling; mechanical lift, 4-page Bulletin P-54. Hamilton Tool Co.
- (76) MATERIALS HANDLING is discussed in a booklet giving 28 pages of ideas for increasing efficiency in this phase of operations. "Turner System of Materials Handling". Factory Serv-
- (77) NEW NEMA FRAME designations and dimensions for ac motors 1 to 30 hp available in a 6-page folder, Form 1676. Century Electric Co.
- (78) SAFETY HAT, named the "Shockgard", is designed for linemen and electrical contsruction workers; dielectric resistance is 10 kv, accessories include a liner for cold weather work. MSA bulletin 0607-1. Mine Safety Appliances Co.
- (79) CORD SETS and related components are detailed in a 30-page catalog that also provides simplified tables showing ampere and voltage ratings of industrial and appliance sets. Cords Ltd. Div., Essex Wire Corp.
- (80) ELECTRIC HEATING for industrial applications is discussed in two new bulletins. GEA-5983, 8 pages, outlines benefits of induction heat as utilized by the forging industry with charts to help determine power requirements. Heating pipelines is covered in the 8page GEA-5095A. General Electric Co.
- (81) EMERGENCY LIGHTING unit is designated the "Light Warden". This portable set has two lamps; charges from any 110-volt ac outlet. 4-page bulletin, Electric Cord Co.
- (82) FLUORESCENT LAMPS are guaranteed to the date stamped on tube. 4page bulletin includes suggested applications for each of nine available shades. Lustra Corp. of America.

- (83) METAL-CUTTING SAW blades, their selection and proper use, are detailed in a 28-page pocket-size guide. Victor Saw Works.
- (84) SOUND SYSTEM paste-up kit helps visualize various arrangements of console and panel assemblies for school installations. DuKane Corp.
- (85) SAFETY SWITCHES and circuit breaker panels are the subjects of revisions of the BullDog catalog. Sheets SS201 and PM300. BullDog Electric Products Co.
- (86) CONTROL CENTERS designed to reduce space occupancy of typical units by 50%. 12-page folder 170 includes planning and ordering instructions. Arrow-Hart & Hegeman Electric Co.
- (87) AIR CONDITIONING unit for industrial and commercial premises. Ceiling mounted cooler is connected to integral fan tower. Kritzer Products.
- (88) Dynamometer Systems for testing motors, compressors, fans, etc.; can be used for motoring and absorption applications. Data gives speed and torque ranges. GEA-5923, 12 pages. General Electric Co.
- (89) Soldering Irons for industry; 40 models from 25 to 700 watts. Hexacon Electric Co.
- (90) Brackets and Poles for street lighting with complete list of accessories. Price list PB-54. Thompson Electric Co.
- (91) Business Telephone system combines paging feature into internal telephone network. 6-page brochure. Automatic Electric Co.
- (92) ELECTRIC HOISTS from 500 to 4,-000 lb capacities are described in a 6page bulletin including safety features, performance and dimensions. Coffing Hoist Co.
- (93) CAPACITORS for ac motor starting. 1-page price sheet. Insulation & Wires Inc.
- (94) Trolley Busway of the 100-amp size is completely cataloged for design, purchasing and installation reference in 44-page bulletin 40. Feedrail Corp.
- (95) LIMIT SWITCH designed for use on machine tools. New catalog addition includes service bulletin, dimensions, applications and prices. Square D Co.
- (96) PLANNED LIGHTING, its application with respect to choosing a light source is covered in bulletin A, 8 pages. Pittsburgh Reflector Co.
- (97) HIGH CURRENT TESTING and calibrating instruments with listing of industrial uses. Catalog MA-154, 4 pages. Multi-Amp. Corp.



Port-A-Pony featherweight Portable PIPE THREADER

Truly a feather weight, the Port-A-Pony weighs only 26 pounds and is ideal for threading conduit and pipe in the shop or field. Use the Port-A-Pony to thread any ¼" to 4" pipe in place. The ½ h.p. reversible motor operates on 110 volts AC or DC. Heavy duty case hardened gears are mounted in a rugged magnesium alloy casing. Adaptable to your die stocks. Write for full information



THREAD-EZY MFG. CO.

CORUNNA



Moisture cannot penetrate the one-piece Neoprene body of a JOY electrical plug . . . when engaged, even its contacts are enclosed in a protective Neoprene housing through the cork-like action of JOY'S famous water-seal. Permanently wulcanized to cable, it cannot crack . . . won't lose its shape . . . and requires no special considerations to insure a long life of useful service. A favorite since '26, JOY electrical connectors are now available in styles and sizes for nearly any portable electrical power transmission need.

Why risk electrical misfits when the best actually costs less, in the long run? Write for full details including literature today!

MORE THAN 100 YEARS OF ENGINEERING LEADERSHIP

JOY MANUFACTURING COMPANY

HENRY W. OLIVER BUILDING, PITTSBURGH 22, PENNSYLVANIA

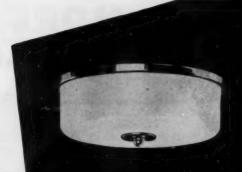
ELECTRICAL CONNECTORS

CONNECT

M.E. 152.1

- (98) ELECTRICAL PLANTS for standby service, 1 to 30 kw, automatic start; gas and gasoline driven models. 4 pages. D. W. Onan & Sons Inc.
- (99) EMERGENCY CLOSER for air magnetic circuit breakers in metal-clad switchgear. 40-lb unit is adaptable for 13.6- or 4.6-kv "Ruptair" breakers. 4-page folder. Allis-Chalmers Mfg. Co.
- (100) STREET LIGHTING and floodlighting equipment featuring several recent developments are described in new catalog. Nepo Manufacturing Co.
- (101) Loom Switch, rated at 2 hp, may be used to control single or multiple shuttle looms. 8-page folder. Arrow-Hart & Hegeman Electric Co.
- (102) Hospital Signaling systems. 12-page bulletin 125 describes operational features of a complete line of hospital communication equipment. S. H. Couch Co., Inc.
- (103) FLUORESCENT STARTERS, guaranteed for 24 months, are available with either pushbutton or automatic (No Blink) reset. Lustra Corp. of America.
- (104) FLUORESCENT FIXTURES, commercial and industrial, and industrial incandescent and floodlight units; illustrations, specifications, and lighting patterns. 4-page catalog. Electro Silv-A-King Corp.
- (105) REMOTE BULB THERMOMETERS for control or recorders and indicators. 44 page catalog gives complete selection and application data, Minneapolis-Honeywell Regulator Corp.
- (106) CONDUCTIVITY TESTER for hospital operating room floors or any location where static electricity might be hazardous. Bulletin 2B. Associated Research Inc.
- (107) COMMERCIAL KITCHEN wiring requirements are described in a new booklet, "Adequate Wiring for Complete Commercial Electric Kitchens". Commercial Cooking Equipt. Section, NEMA.
- (108) ANNUNCIATOR ALARM systems, single relay type; description, dimensions and wiring diagram of Econ model annunciator. 2-page bulletin. SCAM Instrument Corp.
- (109) HEAVY-DUTY MOTORS designed to meet new NEMA standards are detailed with illustrations and charts showing construction features and dimensions; sizes—½ to 125 hp. Bulletin 37-205. Electric Products Company.

ART METAL DRUMS



VEEDRUM

Opal glass— 100 to 400 watts

LENSDRUM

Prismatic glass—clear glass bottom 200 to 300 watts



TAPERDRUM

Opal glass— 100 to 300 watts

Consult your Authorized
ART METAL Distributor or write
for detailed bulletin.



- Approved by Underwriters' Laboratories, Inc.
- Tested for higher fixture wattage ratings.
- · Connection to any standard building wire.

SAVE!

- Time saving installation.
- · Time economizing maintenance.
 - Time tested construction.

THE ART METAL COMPANY

Manufacturers of Engineered Incandescent Lighting

MORE POWER IN SMALLER FRAMES

SAVE



WEIGH

NEW Century

Form "F"
Fractional H.P. Motors

NOW AVAILABLE IN 1/4 TO 3/4 H.P.

Thanks to new techniques developed in the last several years, this *smaller* power package combines improved performance with even greater Century dependability.

Here's What New Techniques Deliver ...

- Better magnetic characteristics for the motor because of more uniform silicon laminated steel in magnetic cores.
- 2 A high dielectric and increased abrasive resistance qualities result from improved plastic insulated wire in the coils.
- 3 Important slot space is saved by improved plastic slot insulation. Extremely tough with higher dielectric resistance.
- 4 Unusual resistance to abrasion, moisture and heat is provided by improved thermal setting plastic varnish insulation on windings.
- Squirrel cage rotors are more uniform because of improved high-pressure die-cast aluminum rotors. Individually, dynamically balanced.
- 6 Increased cooling ability is provided by improved ventilation.
- 7 These new Century Motors incorporate all mechanical features proved effective in thousands of varying applications.

For full details on Century Fractional H. P. Motors—write for bulletin 1-5 Page 1. Century also offers a wide range of types and sizes in AC and DC...1/8 to 400 H.P.



CENTURY ELECTRIC COMPANY, 1806 Pine Street, St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

832

QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay \$5.00.

Reader's Quiz

Constant Current Transformers

QUESTION E25—I have checked the manufacturers' literature and text-books with regard to safe loading possible with constant current transformers. Can any reader advise the possibility of utilizing these transformers at an overload and what is the maximum percentage allowable?—L.W.F.

ANSWER TO E25—The overload any electrical equipment can carry is determined by the allowable temperature rise. Too much current means I^aR losses will reach the point that heat will begin to build up within the apparatus, and insulation will be damaged.

Electrical equipment will generally withstand 50% overloads at intervals without harm, and utility companies frequently operate distribution transformers at 25% to 30% overloads continuously. But here no definite rule can be stated, and experience must serve as a guide. Overloading equipment is frequently justified from an economic standpoint, but it must be recognized that service life will probably be shortened.

As the main danger in overloads is the extra heat generated, any means of reducing the heat will increase the capacity. Forced ventilation would probably materially increase the continuous rating of these constant current transformers.—D.H.N.

ANSWER TO E25—Constant current transformers are designed to operate at full load. While it is impossible to damage a constant current transformer by overloading it, the output of the line will drop as the overload increases. The transformer will not deliver rated current, but some quantity lower, depending upon the amount of overload, with the result that the lights will be dimmer. With 20% overload, the drop will be about 0.1 ampere.—R.S.

ANSWER TO E25—Constant current transformers are used for exactly what the name implies, whether it be series lighting, are lighting or wherever a constant current is required.

Your chief concern is the possibility of overloading and to what extent. Therefore with full load on the transformer, the primary and secondary coils have moved together as close as possible, thereby producing maximum voltage and cutting maximum flux. The current at full load is still maintained at a constant value of about 6.6 amps, 7.5 amps or whatever value the transformer design states.

However, by increasing the load, the voltage and flux being cut are at their maximum values, the value of current must be decreased depending on the amount of extra load. By increased overload the current drops below its normal value. Therefore, the amount of load or overload is determined by the point at which the current desired is maintained.—J.B.K.

Transient Voltage

QUESTION F25—Why would incandescent bulbs rated at 120 volts burn out when a light plant shorts out? The light plant rating is 1000 watts, 120 volts. The normal load rating is about a thousand watts.—E.S.H.

ANSWER TO F25-The problem that occurs here is one of transient voltage. When a light plant of the type mentioned shorts out, it is probably an intermittent short that first appeared, and later this short became a permanent one. The power plant tried to maintain voltage on the short, and therefore raised its generating potential; then when the short disappeared for a moment, this allowed the generated voltage to shoot up to around 150 or possibly 200 volts, momentarily, which thereupon blew the light bulbs. Transient voltages are something that must be watched carefully and can cause serious damage.-H.H.S.

ANSWER TO F25—Any light plant generator overloaded far beyond its rated capacity by a short circuit, will rapidly decrease its speed and corresponding voltage.

The sudden removal of the shorting condition will rapidly increase its speed and voltage, so much so, as to lead any governor mechanism the light plant may have. It is this momentary pulse of over-normal speed that provides the over-voltage that burns the lamps out.

In this instance, I suggest the use

of 10 amp. low-lag fuses at the light plant's output terminals, and if this does not correct the trouble, add lowlag fuses at each lamp with a current rating to match.—J.J.R.

Generator

QUESTION G25—We have a dc generator compound-wound, 25 kw, 200 amps, 125 volts, 7165 rpm. Not long ago it quit generating under load. After overhauling, we tested bar to bar on commutator and field coils for open grounds or shorts, but could not find anything wrong.

After reassembling we got it generating by moving rocker forward to increase voltage. It runs fine idle but as the load increases the voltage drops. The present load is between 90 and 100 ambs.

What causes this condition? What test would I have to make to find trouble and remedy same?—A.T.

ANSWER TO G25—It would appear that the "drop in voltage as the load increases" is caused by a difficulty in the field coils and that the generator was operating as a shunt machine. Suggest testing the series and shunt fields for continuity of circuit—check the polarity of each field coil—check all connections for a high resistance contact—be sure series and shunt field are not bucking each other.—A.P.B.

ANSWER TO G25—Apparently the generator was compounded properly and working satisfactorily prior to the original trouble. It is therefore reasonable to assume that the trouble occurred in connecting the leads when re-assembling. With a differentially wound machine the shunt and series field coils oppose each other and as the load increases the series field is strengthened and has a tendency to reverse the e.m.f. in a generator, which would account for the decrease in voltage.

The trouble can be corrected by interchanging the leads of either the shunt field or the series field. The generator will then be cumulatively wound and the series field will assist the shunt field in establishing the inducing flux. The generated e.m.f. will therefore increase or remain constant as the load increases depending on the amount of compounding.—W.H.B.





ANSWER TO G25—"It runs fine idle, but as the load increases the voltage drops." This would indicate that either the entire series field, or one or more series field coils, had been reversed when the generator was overhauled. The simplest way to check this would be to reverse the series field.

If, after reversing the series field, the voltage can be maintained at full load, 200 amperes, nothing further need be done. The individual series field coils (or shunt field coils) can be easily checked with the generator shut down by taking a standard automobile battery, 6 volt (or 12 volt) to supply 25 to 50 amperes to the series field coils in series. The current will have to be limited with .12 ohms in series with the battery for a six volt battery (.24 ohms for a 12 volt battery). With current through the series field coils (or the shunt field coils, if these are to be checked) hold a crescent (or open end wrench, or any convenient piece of steel) against the pole tips of each adjacent pair of poles in turn.

If the polarities are correct, the two ends of the wrenches not against the pole tips will be attracted to each other, when brought together. This is a very simple method of locating a field winding of reversed polarity on any pole.

—I.P.

Underground Distribution System

QUESTION H25—With an underground steel conduit distribution system at 4800 volts, it has been found that due to a water condition, a great deal of water gets into manholes (actually pull boxes about 24 inches deep) and drains into the transformer vaults to a depth of several feet.

Can someone tell me how to keep the water from entering the conduit and draining into the transformer vaults.—J.C.

ANSWER TO H25—Your cheapest and most satisfactory solution in this case would be to install a sump pump if it is possible to do so with your present clearances. The sump and all associated piping should be installed in a corner as far away from electrical equipment as possible and isolated by an enclosure, or wall.

The vault should have been provided with means for draining when it was built. Section 4546 of the National Electrical Code requires provisions for drainage if practicable when transformer capacity exceeds 100 kva.—W.R.S.

ANSWER TO H25—To eliminate the undesirable entry of water through

ducts to the transformer vaults it is suggested that the ducts leaving the manholes be sealed against the entrance of water.

A rather effective method is to use "Duxseal" a product put out by Johns-Manville and made especially for this use. It is a non-hardening adhesive plastic compound of a putty-like consistency. After the cables are pulled in and other work completed, "Duxseal" is applied to seal the area between the conductors and the duct. It can be easily removed should the occasion demand the cables be removed or changed. For additional protection also seal the duct as it enters the transformer vault.—L.R.B.

ANSWER TO H25-The alignment and grade should be fixed by the aid of surveying instrument to insure drainage and avoid pockets. Dips whereby water will stand and freeze should be avoided by driving a pipe of approximate 6 feet by 11 inches in diameter, with a well point, and sunk at the lowest corner of the hand-hole (boxes). Here the water will drain out. Should the rain water be excessive and the boxes fill up, they (the boxes) will drain through this pipe and through the conduit to the transformer vault where you should install a sump-pump over a catch-basin placed in the lowest corner sunk to the level of the floor. A sewerage disposal line if nearby, should be connected to the sump-pump. If not, the pump line should be emptied into the surrounding ground area, toward down-grade.

Do not plug the conduit, as water settling may in time injure the insulation.—O.C.

Testing Motors

QUESTION 125—One of our customers manufactures 25 and 50 cycle phonograph motors for export. He needs a source of power for testing these units. Is it possible to get this power from a single MG set without the bother of changing belts?—H.G.C.

ANSWER TO J25—Purchase a motor with two output shafts. Motor should be a frequency and phase as per supply available. Purchase a 50 cycle and a 25 cycle generator each of the voltage and phase required, and either couple each generator to the respective motor shafts forming a motor generator set or if the generator speeds are not suitable for direct connection, these generators can be belt-driven from the common motor. If none of these plans are suitable, secure the generators and belt them to existing line shafts.—A.P.B.

PIERCE QUALITY FUSES

build your reputation

provide better protection





10% to 40% Cooler Operation

. . . assured by Pierce Screen Vented construction. Gases and heat are allowed free escape.

No unnecessary blows during safe overloads

. . . thanks both to famous Pierce balanced lag link construction and unique Pierce screened venting.

No danger of afterblow

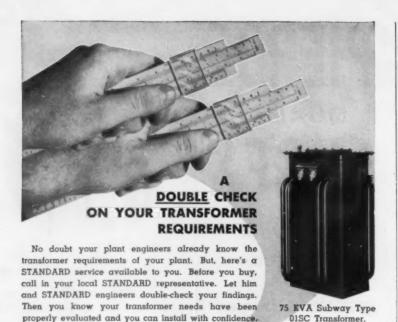
. . . because dangerous gases and heat cannot build up in the case. Pierce cases last 6 to 8 times longer!

WRITE TODAY for this helpful bulletin on lower fuse costs. Start NOW to save and profit through Pierce protection!

Also a complete line of quality non renewable fuses,



PIERCE RENEWABLE FUSES, INC.



CHESTOOR PROPERTY TO

WARREN, ONIO
REPRESENTATIVES IN PRINCIPAL CITIES





KEYSTONE WIREWAYS AND AUXILIARY FITTINGS ARE QUALITY BUILT FOR QUICK INSTALLATION!





Next time you're figuring a wiring installation job, you'll find it pays to specify Keystone Wireways and Auxiliary Fittings. They're quality built from end to end... designed to permit quick, easy, economical installation of wiring for main power lines, feeders, branch circuits, meter boards, service boards, loadside switches, etc. And they're available in both flanged and flangeless styles in the most complete range of sizes and lengths... $2\frac{1}{2}$ " x $2\frac{1}{2}$ " x 1' through 8" x 8" x 5'... to meet your exact requirements.

FREE CATALOG describes and illustrates the entire line of Keystone Wireways and Fittings, Cutout Boxes, Pull Boxes, Outlet Boxes, Switch Boxes, Covers, and Bar Hangers. Contains complete specifications and prices. Send for your free copy today!

KEYSTONE MANUFACTURING COMPANY

23328 SHERWOOD AVENUE CENTER LINE (Detroit), MICHIGAN



Sold Through Leading Electrical Distributors Coast-to-Coast

ANSWER TO J25—I suggest that the motor generator set be made up with a two-speed induction motor driving synchronous generator that is rated to produce the required power at either 25 or 50 cycles without overheating. This generator will have to be belt or gear driven since it must run at 50/60 of the speed of the driving motors.

For example, a two-speed squirrel cage induction motor 1800/900 rpm operation might drive a generator rated for 1500/750 rpm, 50/25 cycles. This method is probably more expensive than using a single speed and changing pulleys to obtain the second speed which offers a quick, easy change of frequency with a minimum loss of production time.

Another method of supplying adjustable frequency power is to apply a standard induction frequency converter. This type of converter is available from the leading electrical manufacturers in ratings from 625 watts to $37\frac{1}{2}$ kilowatts and it offers the advantage of being a factory engineered, self contained equipment, mounted on the common base.—L.D.B.

Reducing Noise of Air Conditioner

QUESTION K25—How can I reduce the noise on the outside side of a window type air conditioner?—H.S.

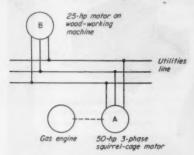
ANSWER TO K25—Besides reducing the air conditioner's efficiency by covering the whole unit with some sort of box affair there is nothing you can do to reduce the outside noise. The noise is an inherent part of the design and is there to stay. The writer's only suggestion is to mount the unit away from other buildings so that the sound does not rebound on the walls.—H.G.C.

ANSWER TO K25—Try rubber mountings and rubber strips, or separators, between the machine and all points where it contacts the building structure.—W.R.S.

Can you ANSWER these QUESTIONS?

QUESTION X25—In radio, television and other electronic devices, is there any source of power other than that of the local power system or batteries? That is, is the electronic device itself a source of power or does it receive power from another source? If so, what percentage is this of the total power.—E.B.

QUESTION Y25—(a) Would it be possible to connect motor "A" to a utility's line as shown and then drive it above synchronous speed with a gas engine to deliver rated current into the line? The object is to permit connection of motor "B" without increasing the current in the utility line, which



would necessitate the installation of heavier feeders. What type of protection would be required between the line and motor "A"? How would capacitors be installed to correct the power factor?

(b) What size 3-phase generator would be required in place of the gas engine and motor "A" to produce the same result? It is not practical to drive motor "B" directly by the gas engine.

—A.S.N.

QUESTION Z25—Do any readers have a wiring diagram of a simple fluorescent tester that is small enough to be carried handily in a tool box?—L.W.F.

QUESTION A26 — Recently I installed a 480-volt, 3-phase ungrounded system, connected Delta-Delta. At the breaker in the building I took a reading from each leg to ground, and got 278 volts. I called the utility company for information concerning this. They told me it was capacitance reactance and that it was common in a Delta-Delta system with a high primary voltage of 13,800 volts. I was also told that it may be harmonic currents.

Could someone tell me more about what causes this high voltage to ground—R.H.L.

QUESTION B26 — What causes brush leads to fall out of the brushes on 300-ampere welding machines? On several occasions I have beer called on welding machine trouble to find that many of the dc brushes have the leads loose or dropped out of the brushes. What is the cause and is there a remedy?—E.S.H.

PLEASE SEND IN
YOUR ANSWERS BY MAY 15





for extra protection against corrosion

SPECIFY Wagner CAST IRON FRAME MOTORS

Here are stock motors specifically designed for use in chemical plants, oil fields, refineries, steel mills—for rugged industrial applications where dust, dirt, moisture, or corrosive vapors are present.

These motors are totally-enclosed in corrosionresistant cast iron and all parts exposed to the atmosphere are of corrosion-resistant material —including the nameplate. They feature completely protected laminations... special varnish treated windings... and a running shaft seal. Wagner Cast Iron Frame Motors are available in fan-cooled standard and explosion-proof types in ratings from 2 to 250 hp, and in non-ventilated standard and explosion-proof types in ratings from ½ through 1½ hp. Wagner Bulletin MU-132 gives complete information.

A skilled Wagner engineer can help you select a Wagner Motor to meet your most exacting specifications. Call the nearest of our 32 branch offices, or write us.



WAGNER ELECTRIC CORPORATION
6413 PLYMOUTH AVE., ST. LOUIS 14, MO., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MƏTORS
TRANSFORMERS
INDUSTRIAL BRAKES
AUTOMOTIVE
BRAKE SYSTEMS—
AIR AND HYDRAULIC

Questions on the Code

Answered by

B. A. McDONALD, New York Board of Fire Underwriters, Rochester, N. Y.
GLENN ROWELL, Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.

B. Z. ZEGALL, Consulting Electrical Engineer, New Orleans, La.

Underground Service

I am having considerable difficulty in a new residential area where the contractor constructing the houses wishes to serve each house with an underground service. The utility, supplying energy in this area, insists that the service conductors coming down their pole in the alley be enclosed within conduit from a point three feet below the cross arm carrying these conductors to the ground level. The contractor has done this, extending the conduit into the ground about 18 inches and terminating in a sweep ell which extends out into the ditch at least a foot away from the bottom of the pole. While he has provided bushings on both ends of this conduit in response to my request, he has neither sealed the top of the conduit nor terminated it just below the ground line, as you suggested I have him do. Is this a Code violation which I can insist upon having corrected?-M.K.

Actually the National Electrical Code does not contain rules governing the two points raised in your question. However. experience in areas subject to freezing weather during winter months has indicated the necessity of sealing the top of the conduit used to protect a conductor run down the pole to keep all moisture out of this conduit. If the top is not sealed, the moisture will enter the conduit and during the winter months when alternate thawing and freezing conditions exist, ratchet action of the ice formed will eventually destroy the insulation on the conductors and bring about fault conditions. There are actually instances in this northern tier of states where this ratchet action of the ice has pinched the copper itself in two. The use of a sweep ell at the bottom of the protecting conduit is not recommended due to the heaving action of the ground during alternate spells of thawing and freezing weather. If the conduit extended down below the frost line and the sweep ell was then employed, it would, of course, not be subject to this heaving action and would perform a useful function. But often it is not practical to bury Type USE conduct-

ors below frost and when that is the case, the protecting conduit should not extend any distance into the ground but should terminate immediately below the ground surface and a loop of the wire should be left at that point in a vertical position to provide sufficient flexibility for this movement of the earth during these changing temperatures. An S type loop, the width of the palm of one's hand, is ample protection against this action.

Under Section 2387 you will note the last sentence reads that unless conductors are specifically approved for the purpose, conduits containing them when in wet locations or exposed to weather shall be arranged to drain. Using this rule of the Code, one can by inference justify the requirement for sealing the top of a conduit that terminates above the frost line in ground because there is no possible way of draining such a conduit.—G.R.

Multi-Wire Branch Circuits

Section 2115 b, 1953 Code advises in the fine print note that a 3-wire 115/230-volt circuit is the equivalent of two 115-volt receptacle branch circuits. Section 4150 permits the conductors of a single branch circuit to be carried through an installation of fixtures approved for end to end assembly to form a continuous raceway. If a 3-wire circuit is equivalent to two 2-wire circuits, do you believe that a 3-wire circuit could be run through fixtures approved for end to end assembly without violating the Code?—C.M.

A If we literally apply the wording of the new fine print note under Section 2115-b, which tells us that a 3-wire circuit is equivalent to two 2-wire circuits, it does appear that a Code violation would be involved if such a circuit were run through an end to end fixture installation. I do not believe, however, that such an interpretation ever was intended. I believe that the new fine print note merely intended to clarify the status of a 3-wire circuit when compared with 2-wire branch circuits. This question

has arisen in the past and undoubtedly needed clarification. The Code under Section 2111 and 2112 recognizes multi-wire branch circuits which may consist of 3-, 4- or 5-wire circuits, and I believe many of us understand that 3-wire multi-branch circuit is equivalent to two 2-wire circuits; that a 4-wire multi-branch circuit is equivalent to three 2-wire circuits; and a 5-wire multi-branch circuit is equivalent to four 2-wire branch circuits. It is my opinion, however, that they retain their identities as single multi-wire circuits irrespective of their equivalent values and I believe Sections 2111 and 2112 support this opinion. In connection with end to end fixture installations covered by Section 4150, it apyears that this question was definitely answered by Official Interpretation No. 287, issued February 21, 1947, which follows:

"Question: Does the expression 'single branch circuit' in Section 4150 of the 1947 edition of the National Electrical Code limit the application of this section to a 2-wire branch circuit?

"Finding: NO."

Official Interpretation No. 297, issued July 17, 1947 more clearly

answers the question.

"Question: May an installation of fluorescent fixtures approved for endto-end assembly be supplied by a multiwire branch circuit?

"Finding: YES."-B.A.McD.

Circuits for Projectors

Recently we installed a projection booth, housing two 35 mm projectors. It is in a small auditorium of a Sanitarium, and seats about 50.

We fed two plugs with No. 12 off two 20-ampere circuit breakers, with each plug on a separate circuit. Each projector draws 1320 watts on 110 volts.

Our question is on Article 540, paragraph 5412. Do we have to feed these projectors with No. 8 wire when they only draw 12 amperes? If so, what do we fuse them at?—J.W.L.

A. You will note that paragraph 5412 applies to the professional



HOW WESCO CURED "GROWING PAINS"

Teamwork, service and a basic understanding of electrical needs were the underlying factors behind electrical modernization at the Wilkinson Manufacturing Company, Fort Calhoun, Nebraska.

Wilkinson's problem was one of "growing pains". They needed more power to meet production schedules. Complete and radical changes in its existing electrical system were certain. Expert handling and complete follow-through were necessary to success. Wesco's function: Act as "trouble-shooter"!

First, Wesco analysed Wilkinson's electrical needs pinpointed present limitations—drafted recommendations for improvements. On the strength of these recommendations, a complete revamping of all electrical equipment, bus ducts and transformers took place. In short order Wesco had worked out the many intricate details—rounded up the necessary materials and rushed their delivery. Result: job completed in record time—Wilkinson completely satisfied.

Apply the same kind of teamwork and electrical knowhow to your problems. With its vast purchasing power . . . specially trained personnel and its years of experience in the field—Wesco is equipped to give you the ultimate in up-to-date service. Whatever your electrical problem may be . . . You Can Count On Wesco.



type of equipment only. Your machine employs 35 mm projectors and these may be of the professional type. So under these conditions it would be necessary to wire them with No. 8.

To protect the machines there is no reason why you cannot use 15-ampere or 20-ampere fuses. These smaller sized fuses will protect the No. 8 wire within the code requirements.

Remember the local inspection authority has it within his jurisdiction to interpret these Code rules within the scope of his immediate work. It is probable that he will permit you to use a smaller size wire, say a No. 12, since this will be ample and of sufficient size for the projector employed.—B.Z.S.

Signal Lights in Operating Rooms

Q. In a hospital, in which they have a number of operating and delivery rooms, does the Code require the signal lights and audible devices in each of the operating rooms which indicate that the electrical circuits are free of faults?—O.M.P.

Under paragraph 4 of Section A. 5135 f. we find the requirement that a green signal lamp shall be conspicuous to personnel in the anesthetizing location and adjacent to that there shall be a red signal lamp and an audible alarm signal which will indicate electrical faults on the ungrounded circuits. In most hospitals having a number of operating rooms, it is common practice to have an operating room supervisor who has an office or desk space in the general area in which these rooms are located, and these signal and audible devices should be located in that office and not in the individual rooms, as the supervisor would be the one person in authority and should therefore be the first to receive the alarm. In smaller hospitals where only a single room is devoted to surgery, the visual devices should be mounted five feet or more above the floor of that room but the audible device should preferably be located in the office of the administrator or person having charge of the hospital and not in the operating room due to the fact most surgeons are definitely opposed to any audible device within the zone of hearing of persons performing surgery. Code does state that an audible device should be adjacent to the visual signals in those instances where the visual signals should be located within the operating room itself, but experience has indicated surgeons will disconnect or order disconnected an audible device

should it be located with the visual lamps in the operating room. Before making such an installation, I feel that the local inspector having jurisdiction should be contacted in order that he may know of the reasons for locating the audible device at some point rather remote from the operating room.—G.R.

Busway Use Outdoors

I have received an inspection application for a 1200-amp 3-phase, 220-volt service consisting of bus duct run on the outside of the building. The bus enclosure is louvered and ventilated, and the bus bars are taped and varnished. The manufacturer's agent insists it is Underwriters' Laboratories approved for "weather proof" use. N. E. Code rule on services states—Service Raceways must be raintight, etc. How will I answer the application for service inspection?—E.N.G.

A In view of the urgency, the following night-letter was sent to E.N.G. "Busway suitable for outdoor use must be so marked on or contiguous with the manufacturer's nameplate and it must bear the label of Underwriters' Laboratories as covered on page 33 of their listing. Before acceptance, I would insist on above marking."

Section 3642 of the Code recognizes the use of busways outdoors or in damp or wet locations when specially approved for the purpose and the fine print note recognizes use as service entrance conductors.

Section 2331 also recognizes the use of busways as service conductors on or in buildings provided the voltage does not exceed 600 volts, but Section 2338 tells us that rigid metal raceways exposed to the weather shall be made raintight and arranged to drain. According to the definition, a busway is a raceway and a raintight raceway is one so constructed or protected that exposure to a beating rain will not result in the entrance of water.

It appears from the foregoing requirements that there could be a conflict in rules when a louvered and ventilated busway is used exposed to the weather. I believe the inspector is correct in questioning such a design of busway as meeting the requirements of a raintight raceway as defined by the Code. If, however, such a design is approved by U. L. and is properly marked for outdoor use, it also appears that the inspector would be justified in accepting same. This question should, in my opinion, be clarified in the Code and the inspector's inquiry supports this contention.

As I understand, the busway in question is intended for service entrance use. However the catalog states that when it is used exposed to the weather, reference should be made to the manufacturer's nearest district office so as to insure that weather-resistant and corrosion-resistant features of design are incorporated in the construction. This indicates the importance of observing the U. L. requirements for marking when any type of bus duct is used outdoors, exposed to the weather.—B.A.McD.

Built-In Wiring

Our company manufactures drive-in windows for banks, where the bank's customers can transact their business without leaving their car. These windows are shipped complete from the factory and installed in a wall opening in the building.

About two years ago we added a built-in lighting fixture and electrical outlets, wiring these at the factory with armored cable and providing several feet of armored cable to tie into the building's electrical system.

Recently we had complaints from electrical inspectors in two different cities on the use of armored cable. We would like to know what wiring method or methods would in your opinion be universally acceptable.—C.P.S.

As far as the code is concerned armored cable with lead covered conductors would fill the bill in all cases. However, you will find that many cities will not accept this construction, some even having ordinances prohibiting the use of any type of armored cable.

To insure universal acceptance, I would recommend the use of conduit and wire, and the use of the newest Code acceptable wiring method, i.e., Type MI cable. I know of no reason, except for some very exceptional installations, such as hazardous locations—which I feel sure you should not encounter—why these two systems would not pass every inspection requirement in all cities.—B.Z.S.

Table 25

Q. Please explain Table 25, Interrupting Capacity of Switches.—H.S.

A Table 25 is a new table appearing for the first time in the NEC in the 1953 Edition. It is to be used in conjunction with the new

Suggestion from ASCA®

in connection with your

modernization program

Install an ASCO "Step Down" **Automatic Transfer Switch**

100 AMP CAPACITY

by "Step Down" we mean a Transfer Switch that will provide full capacity on normal and selected "pre-rated" reduced capacity on emergency. For example, on emergency, you might want to keep only a refrigerator unit going-or only a certain lighting circuit. Any number of emergency load combinations can be worked out and the proper switch "step down" selected.

We'll be glad to help lay out any such system and

to recommend the proper switch and hookup. We'll bring to the problem some 65 years of experience in the design, manufacture and application of Electromagnetic Controls. Tell us about your problem.

We also design and manufacture many types of Remote Control Switches, Contactors, Relays and Complete Control Panels, as well as an extensive line of standard and special Solenoid Valves.

Suggested hookup for a 400 ampere load normal and 100 ampere load emergency system.





By making 12 90° bends in 3" conduit with a TAL ONE-SHOT BENDER instead of using elbows and couplings, time was cut from 59 to 39 hours . . . \$134 was saved on labor and material on installation of a 250 hp, 220 volt, 3-phase air compressor in the shop of the Diamond T Motor Car Co., Chicago. This was possible only because a TAL ONE-SHOT completes bends in one setting-no shifting of pipe is necessary!

BENDER, INC.

DEPT. 21 . MILWAUKEE 2, WISCONSIN

20 hours in time \$64 in materials SAVED ON ONE JOB WITH A TAL PORTABLE BENDER

COMPLETE LINE OF BENDERS

- For copper and thinwall
- 6-Way Hickory

Price Price of Ten Sizes Each \$3,10 ea. \$3.70 3.90 ea.

. EXTRA STUB HOLE

- SIX WAY NON-SLIP SHORT BEND. ING JAWS for close quarters or open slab work. Hon-Slip, Accurate, Rapid and Easy Bending.
 - SAFETY NECK for SURE GRIP.

Safety Neck Extra Stub Hole

6.65 ea. 7.95

requirements set up in Article 430.

Specifically, Table 25 is referred to by Sections 4383e and 4403b. These sections apply to the rating for the motor controller and the motor disconnecting means, respectively, for the "Sealed (Hermetic Type) Refrigeration Compressor Motors'

Considerable difficulty has been encountered in the field in the installation of these motors. Briefly stated, this has resulted from motors having horsepower ratings which are lower in value than their nominal rating, if these ratings had been based on the actual nameplate full load current ratings of these motors.

To illustrate this, the following problem will be worked out in detail. It should be noted that in this problem, no cognizance is taken of the various exceptions and alternatives offered by the code for wiring this particular motor. Only a straightforward solution is shown to present the picture simply and concisely.

It will be assumed that on a certain plan, the specifications call for wiring of a 71/2-hp, 3-phase, 220-volt, standard squirrel cage induction motor for an air conditioning job. The successful electrical contractor installs his circuits, main switch, etc, based on the nominal value of 22 amperes full load current shown by Table 24. Thus his branch circuit conductors must have a minimum current carrying capacity of 1.25 x 22 or 27.5 amperes. Three No. 10 wires in 3-in. conduit (Tables 1 and 4, respectively) will be ample for this (Section 4312).

The main disconnecting means will be selected to carry a standard fuse or be a standard circuit breaker having a rating for a current of at least 3 x 22 or 66 amperes. Thus a 100-ampere switch (rated at least 71/2-hp, Section 4402) with 70-ampere fuses, or a 70ampere circuit breaker would be used.

The motor controller would also be rated 71-hp and have running protective devices rated for at least 27.5 amperes. Actually, these devices would have to be rated on the motor full load current rating (Section 4322) so that this protection could not be applied until the actual motor is on hand and

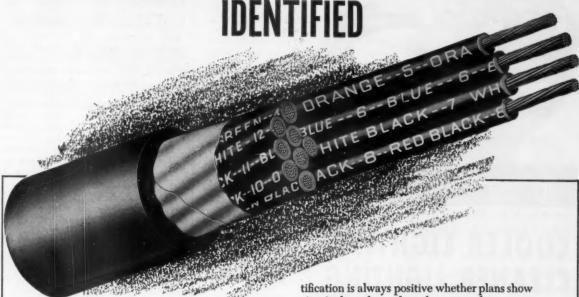
available for installation.

When the motor finally arrives on the job it is rated as above, viz., 71/2hp, 220-volt, 3-phase, squirrel cage. But its nameplate full load current rating is 35 amperes and it shows a letter "H" for its "Identifying Code Letter"

(Section 94304).

On the basis of this 35-ampere rating, the minimum current carrying capacity of this branch circuit would have to be 1.25 x 35 or 43.75 amperes. Three No. 8 Type RH, etc., in 3/4-in. conduit or three No. 6 Type R. etc.,

Roeplastic control cable -THE ONLY CONTROL CABLE WITH CIRCUITS OSITIVELY



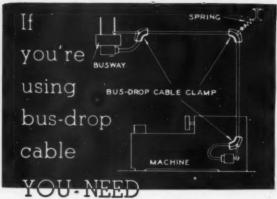
THIS NEW Roebling ROEPLASTIC Control Cable makes circuit identification quick and certain for the first time in history. A workman can't go wrong even if he's color blind. Here's why:

In ROEPLASTIC Control Cable, each conductor is identified from end to end by both its IPCEA code color name and its individual number by means of an indelible printing against a strongly contrasting background. The printing is permanent; it cannot fade or rub off...idencircuits by color code or by numerals.

Roebling ROEPLASTIC Control and Signal Cables are ideal for such purposes as remote control of motors, switch gear, automatic machinery, etc.... for traffic light control, relay, metering and supervisory circuits. They are made in constructions, types of insulations and over-all sheaths to meet every specific requirement. Write for technical data...and order ROEPLASTIC Control and Signal Cables from your Roebling distributor. John A. Roebling's Sons Corporation, Trenton 2, N. J.

Subsidiary of The Colorado Fuel and Iron Corporation





"Sky-7ie"

Cable Clamps

For support at overhead suspension;

To anchor at busway and machine tool.

Easy to install. Adjustable to cable diameters.



COOLER LIGHTING CLEANER LIGHTING LONGER LAMP LIFE



This original ABOLITE idea starts automatic air circulation around the lamp and thru the ventilator slots of the ABOLITE reflector thus keeping lamp and reflector surfaces cleaner, longer. Lamp necks stay cooler to provide maximum lamp life.

ABOLITE is your first choice in lighting reflectors. First with new ideas — ventilator slots, all-white porcelain finish. First with practical features for easy installation — outlet box reflectors. First with the new designs for new type lamps—the Protecto-Shield for R-52 and R-57 lamps. There's an ABOLITE for every lighting requirement.



THE JONES METAL PRODUCTS CO. • West Lafayette, Ohio

OTHER FIRSTS



REFLECTOR
Available in both RLM and
Shallow Dome designs.



No more unsafe "naked bulbs." Two piece socket and reflector form single lighting unit that screws into any socket. No tools needed. Law priced.



FLOOD LIGHTS A complete line for every application from parking lots, and railroad yards to sign lighting or sport fields.

in 1-in. conduit must be used. In this case, since a ¾-in. conduit is already in place, the Type RH wire would be used. But the No. 10 would have to be replaced with the No. 8.

The main disconnect size would be based on 3 x 35 or 105 amperes. Now at least a 200-ampere switch with 125-ampere fuses, or a 125 ampere circuit breaker would be required. With the 100-ampere switch in place as outlined above, this could be taken care of by using time delay fuses (Section 4346). With a 7-ampere circuit breaker in place, it may be possible to replace the trip units, but if not the replacement of the breaker could be a major job.

Both sections 4383e and 4403b point up this problem and provide working procedures for obtaining properly designed circuits for these "Sealed Motor" units. For both the motor controller and the motor disconnecting means the Code requires selection "on the basis of both the nameplate full load current and locked rotor current, respectively, of the compressor motor". In effect this will require full specific information for these motors before any plans or specifications can be written for the electrical work.

In the case of the motor controller, this new section 4383e will require the following calculations, using the above example to determine the proper size of motor controller. On the basis of the full load current rating, i.e., 35 amperes, Table 24 shows a hp rating somewhere between 10 hp (27 amperes) and 15 hp (40 amperes). (See third sentence of Section 4383e.) The Code, however, requires the use of a 15-hp controller (see fourth sentence of Section 4383e).

With a letter "H", section 94304 shows a range of 6.3 to 7.09 kilovolt amperes per horsepower, with locked rotor current. Thus the low kva would be $7\frac{1}{2} \times 6.3$ or $47\frac{1}{4}$ kva and the high, $7\frac{1}{2} \times 7.09$ or 53.175 kva. The lower locked rotor current would be 47.250/1.732x220 or 124 amperes. The higher value, using a similar calculation would be 139 amperes.

Table 25 shows $7\frac{1}{2}$ hp (132 amperes) for the 124-ampere value and 10 hp (162 amperes) for the 139-ampere value. The 15-hp size calculated from the full load current value would have to be selected (see last sentence of 4384e).

Basically, Section 4403b requires similar considerations for the selection of the disconnecting means.

It should be noted that the values shown in the above example are purely hypothetical. They have been selected to specifically illustrate the full use of these new sections of the Code. In general, they may or may not correspond to some specific motor characteristics.—B.Z.S.



...take the current where the tools go!

Only "POWR-KORD" offers the complete safety of MOLDED-ON attachments...every component part fully UL listed



Have you had a sample of

ROYAL-LAG time-delay PLUG FUSES?

Write for a sample and literature

Receptacles In Garages

According to the old Code, the question of using a receptacle in a garage occupancy in a fixed position in an outlet box in a wall was controversial. As a result, some inspectors required such receptacles to be connected to the outlet box by the use of a short piece of heavy duty cord. This procedure permitted the receptacle to follow the direction of any strain on the cord and permit it to readily pull apart rather than damage any part of the circuit. Has the 1953 Code clarified this question?—S.M.

According to the 1953 Code, A. the hazardous area in a commercial garage includes the area within 18 inches of the floor as covered and explained by Section 5105-b. As a result, any receptacle installed within 18 inches of the floor must satisfy the requirements of Section 5022, which requires the use of polarized receptacles and caps with provisions for grounding the equipment to be served and the use of receptacles which are approved for a Class 1 hazardous location. In order to satisfy these requirements, it appears to me that a receptacle in a fixed position must be used. While such procedure is not usual, the application which is recognized by the Code does, to some extent, answer your question. When the receptacle is installed above the 18-inch hazardous area, however, there is a contradiction to the foregoing. Section 5105-e-5 indicates that a receptacle in a fixed position shall be located above the 18-inch hazardous area. The same section also limits the use of a pendant receptacle to an area 18-inches or more above the floor. As a result of these rules, there is no question regarding the use of either type of receptacle. fixed or pendant, when installed above the 18-inch hazardous area. A question, however, does remain. May a receptacle approved for a Class 1 location be installed within 18 inches of the floor? Section 5105 says No. Personally, I do not believe this was intended. It appears to me that a receptacle approved for use in a Class 1 location which includes occupancies more hazardous than garages, would also be considered safe to use in the hazardous area of a garage .-B.A.McD.

Instrument Enclosures

Q. I have undertaken the task of designing and supervising the installation of an instrument panel





- MOLDED-ON CAPS AND CONNECTORS
- FOR PORTABLE TOOLS (indoor and outdoor), LIGHTING, TEMPORARY INSTALLATIONS, MACHINES, etc.
- LENGTHS FROM 10 to 100 FEET

Ask your ROYAL wholesaler for the "POWR-KORDS" that fit your requirements, and

USE THEM ON EVERY JOB!





HERE'S SAFETY-SERVICE

you can always depend on. For Klein tools and equipment are designed better for your jobs—made of the finest materials—individually tested and inspected. Look for the familiar Klein trade-mark—serving the electrical industry "since 1857."

ASK YOUR SUPPLIER
Foreign Distributor:

International Standard Electric Corp., New York



which must be located in a room in which gasoline vapors are likely to be present. As several of the instruments are of the recording type, making it necessary that charts be changed at 24-hour intervals, I am faced with a very serious problem if I must conform to paragraph a. of Section 5013 of the National Electrical Code. Would it not be possible to use conventional instrument enclosures in such a location providing current values could be sufficiently reduced?—M.L.

At the present time the National Electrical Code provides no alternative method for instruments which must be located in a Class 1, Division 1 location, such as that with which you are apparently confronted. There is no question but that it will be possible some day to design an instrument using current values sufficiently low which can be successfully used in a hazardous atmosphere. However, tests which have been under way in both this country and in England for some time have not as yet been concluded, and while they have turned up evidence making it practical to continue these tests, we do not as yet have sufficient factual evidence accumulated to determine safe current values for use in various types of hazardous atmospheres.

I personally believe the simplest solution to your problem might be obtained through the use of instrument enclosures sufficiently strong to withstand internal pressures in excess of three pounds per square inch. Then, by the use of a bellows-actuated switch in the current supply circuit to these instruments and a simple air compressor to maintain a pressure of three pounds or more within these cases, you could devise a safe method of utilizing recording instruments within a hazardous location. This would be especially true of a recording type device where it was necessary to open the enclosure and change charts at definite intervals as the device would be removed from the circuit when the pressure dropped below three pounds and could not again be energized until the case was closed and the pressure had reached three pounds within it. On the other hand, if a listed explosion-proof Class 1, Group D enclosure were provided, its value becomes questionable after it has been opened due to the possibility of improperly replacing or fastening the cover. As this pressurization method is not as yet covered by the National Electrical Code, unless the device in question has been listed by the Underwriters' Laboratories, I would suggest you contact the inspection authority having jurisdiction in the area in which this installation will be made and dis-

The Quick, Easy Way to Remove an Object from a Shaft!



The Improved Hydraulic PULLEY PULLER

For Removing Pulleys, Wheels, Gears, Couplings, Sheaves, etc.

One man can do it in minutes even if objects are stuck fast. No crowbars, sledges or blowtorches. No damage to equipment. Puller is adjustable — easy to move — rugged. Hundreds being used in industry.

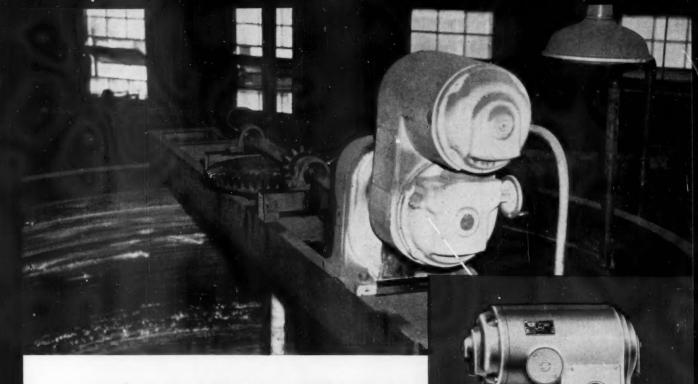
- 5-ton size on
 wheels \$101.75
 20-ton size on
 wheels \$319.00
 50-ton size as
 shown \$720.50
 - F.O.B. Factory
 Write for complete
 information Catalog D

INDUSTRIAL ENGINEERING EQUIPMENT CO.



1

4



THE HUMKO CO. GETS EXACT SPEED CONTROL ON MIXERS WITH SPEED-TROLS

Mr. J. H. Kirby, Vice-President of The Humko Co., writes: "In processing vegetable oil and shortening we must drive our mixers at various speeds... a Speed-Trol was installed for this purpose... we were so well pleased with its performance that we installed Speed-Trols on *ALL* of our vegetable oil mixers... Speed-Trols give the exact speed regulation needed for vegetable oil processing."

Industry Names Speed-Trol Production Advantages

In a nation-wide user survey of Sterling Speed-Trol Variable Speed Electric Power Drives:

86% Increased Production. 48% Improved Product Quality. 64% Reduced Production Costs. 42% Modernized Equipment and Machines. 20% Reduced Spoilage and Rejects. 28% Increased Machine Versatility. 18% Increased Plant Safety. 34% Improved Employee Morale. 62% Lowered Maintenance Costs.

46% Saved Space. **18%** Simplified Operations. **16%** Synchronized Operations.

Investigate the possibilities of bringing some of these Speed-Trol production advantages to your plant. Sterling Engineering Sales Offices and over 400 Distributors and Service Shops throughout the nation effectively serve every industrial, commercial and agricultural area.



20-PAGE ILLUSTRATED CATALOG
... Sterling Speed-Trol, SloSpeed, Klosd and Klosd-Tite
Electric Power Drives. Write
for catalog No. D-416

There is a Sterling Electric Power Drive to Meet Virtually Every Requirement

Sterling Slo-Speed Electric Power Drives—for geared low speed at its best Sterling Klosd and Klosd-Tite Motors—for constant normal speed at its best

STERLING MOTORS

Plants: New York City 51 • Chicago 35 • Los Angeles 22 • Hamilton, Canada • Santiago, Chile
Offices and distributors in all principal cities







Converts Kalamazoo Metal Cutting Band Saws to fully automatic cut-off machines

Feeds conduit, pipe, rounds, flats, hex, etc.—any length 3/16" to 12".* Gives you the savings of full automatic cutting never before possible at such low cost.

GET DETAILS FROM YOUR KALAMAZOO DEALER, TODAY.

*Additional feeding length to 30", at extra cost.

MACHINE TOOL DIVISION

Kalamazoo TANK &

440 Harrison Street, Kalamazoo, Michigan

cuss with him the advisability of using either explosion-proof or pressurized devices. I might add there has been for some time a lighting fixture listed by the Underwriters' Laboratories which operates under this pressurization principle.—G.R.

Small Motors On One Circuit

Q. Section 4343 of the Code permits several small motors to be connected to a 15-ampere or 20-ampere branch circuit. Will you explain that part of the rule which requires, in some cases, additional overcurrent protection for some motors? May the circuit be loaded to its full capacity?—E.T.H.

A In order to clarify my answer I am showing by the illustration the application of the provisions covered by Section 4343 and 4322, as they apply to a 115-volt, 20-ampere branch circuit. Section 4343 permits

Protection required on above motors —
A. 20 ampere overcurrent device.
B.-C. Separate overcurrent device. 125% of motor full load current for other types. May be modified per 4324. Protective device integral with motor also recognized.

D-E. May need only 20 amp. protection.

two or more motors, each not exceeding 1 hp in rating and each having a full load rated current not exceeding 6 amperes, to be served by a branch circuit protected at not more than 20 amperes at 125 volts or less, or 15 amperes at 600 volts or less, provided individual overcurrent protection is satisfied when required by Section 4322. Reference to Section 4322 shows that additional protection is required in some cases.

According to the illustration Motor B is manually started but is out of sight from the starter location. It therefore must have additional protection. Motors C-D-E are automatically started motors and must have separate overcurrent protection with an exception for oil burner installations or high impedance motor windings such as clock motors. The type of additional protection required is shown on the

illustration. The same rules apply to either single or three-phase branch circuits, such as 220- or 440-volt three phase circuits. When the voltage of the circuit is greater than 125, it must be protected by a 15-ampere device.

While the loading of the circuit does not appear to be definitely covered under these rules, it is understood that the branch circuit overcurrent device should be able to start any of the motors when the others are operating without opening the circuit. In view of the many variables involved, it appears difficult to make a fixed rule on this point. The nature of the loads and the type of fuse or circuit breaker all have a bearing on this question. Section 2125-a of the Code recognizes this feature and limits the loading on a branch circuit which supplies both motors and other loads to 80% of the circuit rating. This provision, how-ever, does not apply to the motor branch circuit under discussion. It is my personal opinion that the loading of the motor branch circuit in question should never be at the full rating of the circuit and that an adequate factor of safety should be considered and applied when such circuits are used .-B.A.McD.

Conductors In Multiple

We are increasing the service to a building and rather than remove the existing service raceway, we would like to install a second raceway and parallel the conductors in each. The present raceway contains three 250,000 circular mil conductors with the fourth wire a No. 2 grounded neutral. As the additional load necessary will consist solely of three-phase heating and power, will the Code require that we also run a neutral conductor in the second raceway?—C.D.

5

Section 3105 is very specific in stating that conductors in sizes 1/10 to 500,000 circular mils inclusive may be run in multiple provided they are of the same length and have the same circular mil area and type of insulation. Then under Section 3018 we find the following requirement: If the capacity of a circuit is such that it is impractical to run all conductors in one enclosure, the circuit may be divided into two or more enclosures provided each phase conductor of the circuit and the neutral conductor, if one is used, are installed in each enclosure. Therefore, for full compliance to the Code, you should replace the No. 2 conductor with one of 1/0 in size and use one such conductor in each raceway.-G.R.



Lady of Lourdes Hospital, Camden, New Jersey

IN HOSPITALS, TOO, IT'S Talk-Don't Walk"

MODERN ARCHITECTUREMODERN INTER-COM SYSTEMS

Modern buildings of all types are wired for inter-com sound systems. Efficiency demands "Talk—Don't Walk."

The beautiful new Lady of Lourdes Hospital at Camden, New Jersey,

The beautiful new Lady of Lourdes Hospital at Camden, New Jersey, has taken advantage of the permanence and trouble-free performance of Belden Inter-Com Cables for its built-in systems. Specifically, Belden No. 8743 is used for its under-pillow radio receivers.

There is a specialized Belden Cable for every inter-com or sound system requirement.

Belden Manufacturing Co., 4623-A W. Van Buren St., Chicago 44, Ill.

Talk-Don't Walk"

For Permanent Installations

For Profitable Work

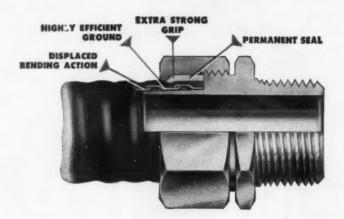
FOR EVERY TYPE OF INSTALLATION FOR EVERY TYPE OF EQUIPMENT BELDEN HAS THE CABLE BUILT T

2

Belden Inter-com CABLE

it's new—an improved connector for liquid-tight flexible conduit

(Sealtite or equivalent products)



PYLE-NATIONAL

"CT" series Connectors offer all these advantages

EXTRA STRONG GRIP

- · Compression force is supported—not by the conduit alone—but also by the body shank, making a vise-like clamp.
- · Gripping is well behind end of flexible conduit for firm anchorage against creeping loose.
- Pliable seamless sleeve makes a plastic-to-plastic grip with the conduit sheath...thereby avoids cutting and abrasion common to metal sleeves.
- · High safety factor of compression range more than compensates for tolerance in the outside diameter of the flexible conduit.

HIGHLY EFFICIENT GROUND

- · Less than 10 millivolt drop.
- · Tapered grounding shank, integral with connector body, makes a firmly wedged contact with the flexible metal conduit.

PERMANENT SEAL

· Plastic sleeve and conduit sheath have equivalent physical characteristics therefore the seal will last the life of the conduit, unimpaired by temperature variations within the limits of the conduit.

DISPLACED BENDING ACTION

· Tapered grounding shank is elongated to extend beyond gland nut, thus avoiding short radius bends which shorten the life of the conduit sheath and more important the permanency of the joint.

"CT" Series connectors can be installed assembled...no parts to lose...no wasted time. Available in straight, 45 degree and 90 degree types for 3/8" to 2" liquid-tight flexible conduit. Meet U/L and J.I.C. standards.









YLE-NATIONAL COMPANY

1344 North Kostner Avenue, Chicago 51, Illinois

Branch offices and Agents in the Principal Cities of the United States . Canadian Agent: The Holden Company, Ltd., Montreal Export Department: International Railway Supply Company, 30 Church St., New York

PLUGS AND RECEPTACLES . GYRALITES . TURBO-GENERATORS . FLOODLIGHTS . CONDUIT FITTINGS . MULTI-VENT

Modern Lighting

General and Local Lighting For Chicago Service Station

Motorists have little difficulty in spotting this Mobilgas Service Station in Chicago, Ill., because gasoline islands, shelter houses, office-garage and grounds, in general, are illuminated by a combination of fluorescent and incandescent units that deliver up to 45 footcandles on a plane measured 2 feet above the ground level.

There are nine pumping islands in all, each with 16-by-2-foot canopy containing eight 2-lamp Phillips fluorescent units equipped with F40T12 cool white lamps. In addition, most of the

canopies are surmounted by short poles that support up to four reflector flood or spot lamps in PAR38, 46 or 56 sizes.

The entire area, which occupies half of a city block, is additionally flood-lighted by banks of PARs mounted high above normal lines of vision at elevations of 30 feet on six steel masts. Lamps on these towers are either 300-or 150-watt PARs, arranged in groups of 3, 5, 8 or 10 lamps per pole, the largest concentration of light being supported by the center front standard

which carries a load of 1500 watts.

Shelter houses, which are located between pumps on either side of the main office structure, are top-lighted by single F40T12/CW lamps, unshielded.

Recipe for Light Cooking

Practicing what he preaches, General Electric lighting consultant R. J. Diefenthaler recently designed a lighting plan that provided an abundance of illumination over all important work areas in the remodeled kitchen of his home in Glen Ellyn, Illinois. Using 14 deluxe cool white fluorescent lamos of varying diameters and lengths, the installation provides at least 20 footcandles of general illumination at all locations, and over 50 fc at sink, range and similar work-centers where high see-ability is essential. The connected electric load, including lamps and trigger-start ballasts, is approximately 500

In the center of the ceiling is a surface-mounted Electro Silv-A-King 2-lamp 40-watt luminaire equipped with translucent ribbed bottom and side panels that provide even, diffuse illumination for upper walls and ceiling surfaces. Also, over the breakfast nook, a luminous valance (product of



SLIDING PANEL above sink opens on living room where television program may be followed by housewife preparing dinner or washing dishes. Sink area is lighted by overhead luminous vinylite plastic panel, while counters beneath adjacent cabinets are also locally illuminated by shielded fluorescent lamps.



EACH PUMP ISLAND is surmounted by a metal canopy containing 16 cool white 40-watt lamps, providing 45 footcandles of illumination for filling gas tanks, checking oil levels and the like. Shelter houses are top-lighted by 40-watt T12s.



SIX 30-FOOT POLES, each one supporting up to ten PAR floodlamps in the 150or 300-watt size, surround this well-lighted service station, while additional PAR units are mounted on shorter masts atop pump islands.

LIGHTING THAT INSURES OPERATING EFFICIENCY



ALLSTATE INSURANCE CO. NEW HOME OFFICE, SKOKIE, ILL.
Architect: Dunlap & Esgar, Inc., 333 N. Michigan Ave., Chicago, III. General Contractor: Kaiser-Ducett Co., 80 E. Jackson Blvd., Chicago, III. Electrical Contractor: Henry Newgard & Co., 4700 W. Fullerton Ave., Chicago, III. Mechanical Engineer: William Goodman, 53 W. Jackson Blvd., Chicago, III.

The new, functional home office of Allstate Insurance Co. provides comfortable, cheerful glare-free lighting that reduces fatigue. Today a number of Allstate offices throughout the country are ELECTRO SILV-A-KING equipped.

Management's experience with these fixtures has proven they provide the quality of lighting required with a minimum of maintenance... while modern styling helps make offices pleasant, attractive places in which to work.

For additional information or a catalog illustrating one of the industry's most comprehensive selections of fluorescent and incandescent lighting fixtures, just write direct.

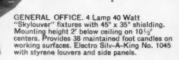
Electro Silv-A-King lighting is used in many Allstate Insurance Co. offices



CAFETERIA. 4 Lamp 40 Watt "Skylouver" fixtures with 45° x 35° shielding. Pendant and flush mounted on 10½" centers to provide average of 35 maintained foot candles. Electro Sitv-A-King No. 1045 with styrene louvers and side panels.

(1

1





2000 W. Fulton St., Chicago 12, III. Fairfield & State, Bridgeport 5, Conn.



L. J. Segil) conceals three 40-, one 20- and one 25-watt tube, all equipped with separate starters.

Local lighting over the sink is provided by four F20T12s, shielded by three 1-foot squares of Benjamin vinylite luminous plastic supported in a home made birchwood frame. Flanking the sink are two under-cabinet coves, each containing a 20-inch T12 lamp, while an F64T6 tube spans the electric range, shielded by the forward lip of the wide cabinet installed immediately above it.

For maximum convenience and utility, all of these lighting segments are individually switched. There are also numerous receptacles above counter tops to supply convenient power for an electric toaster, mixer, blender, juicer, coffee grinder, iron or radio. Also in the interest of convenience is a telephone outlet in the kitchen and, if the home owner wishes to keep track of a favorite television program while she prepares food or washes the dishes, she need only slide back a panel over the sink and look directly at the TV set located in the recreation room.



14 FLUORESCENT LAMPS, installed behind translucent panels and beneath cabinets, provide illumination intensities running from 20 to above 50 footcandles for all surfaces in this cheerful, modern residential kitchen. Convenient plug-in receptacles and telephone outlet also add to pleasant workability.

Modern Lighting in Home for Aged

What planned lighting can contribute to architectural design is well exemplified in the new Mather Home for Aged Ladies, Evanston, Ill., which project as a whole is a welcome sight to those interested in better housing for old people.

New in every respect, the 7-story and basement building was endowed by Alonzo Mather, who made his fortune in the early part of the century with the Mather Stock Car Company.

The architects for this project, Childs & Smith, Chicago, wanted a building which would be modern and functional and that would provide a comfortable "non-institutional" homelike atmosphere. Thus the basic plan of construction which they evolved is similar to apartment building with special considerations for requirements of elderly people living in a group.

The architects commissioned Solar Light Manufacturing Company of Chicago to design a lighting system that would complement their own plan Solar designers attempted to give the

LARGE SHALLOW chandeliers harmonize with decor of large spacious dining room in Mather Home for Aged Ladies. (Top right)

BED LIGHT in typical bedroom is wall mounted, of the direct-indirect fluorescent type. Fluorescent ceiling unit also lights dressing alcove. (Bottom right)





JOINED for LIFE with DOSSON SERVICE CONNECTORS



The choice of connectors is wide, but there's a big difference when you choose a Dosson. Years of testing under the worst weather and corrosion conditions give undisputed proof of Dosson's permanent grip. Makes quick, simple, efficient connections for solid and stranded conductors in sizes No. 14 to 1000 MCM. High contact pressure between conductors assures maximum security . . . eliminates maintenance. Check these important Dosson features:

- 1) High translation of torque by low coefficient of friction
- 2) High contact pressure
- 3) Free from vibrational loosening
- 4) Withstands high tightening torque
- 5) Maximum contact area
- 6) Made of high strength "DURONZE" alloy
- 7) Better conductivity
- 8) High corrosion resistance
- 9) Economical—usable over and over again
- 10) Dossert precision-manufactured

IN STOCK FOR IMMEDIATE DELIVERY



DOSSERT REPRESENTATIVES IN PRINCIPAL CITIES



CEILING LIGHTS of special design light the wide hallways with plenty of comfortable illumination, give space an attractive and youthful appearance.



CHANDELIERS and table lamps of ornamental design light the spacious lounge and sitting room, supplemented by ceiling recessed down lights.

home a friendly, cheerful appearance through use of specially designed, imported chandelier type units. The objective was to complement the large amount of natural lighting provided by the architect, with the necessary bright lighting needed for halls used by elderly people, while avoiding a depressing, institutional appearance.

Solar Light engineers made use of both direct and indirect lighting, with the result that their plan utilizes incandescent emphasis luminaires, fluorescent fixtures, chandelier units and the more conventional floor and table lamps. The resulting effect is one of simple beauty, yet one of adequate and comfortable lighting.

The entire electrical system, including the planned lighting system, was installed by the White City Electric Company of Chicago,

Cold Cathode Lamps Light Ford Display

A ceiling of light, literally formed with cold cathode lamps, very effectively lights the unique new Ford display pavilion at the State Fair Grounds, Detroit, Mich. Entirely supported by a central column, this ceiling is hexagonal, spans 100 feet at its widest point, and floats in the air 14 feet above the display floor.

1

Designed without walls as a permanent showroom for the Greater Detroit Ford Dealers, this display pavilion provides complete freedom of spectator movement and an unimpeded view of the interior.

A lightweight roof covers the area, attached to the top side of a framework of I-beams. Specialty manufactured



CRESCENT

OVER 70 YEARS EXPERIENCE

For more than 70 years CRESCENT Wires and Cables have played a leading role in the growth of the electrical industry. Pictured and described here are just a few of the many wires and cables that are made by CRESCENT.



ABC ARMORED CABLE

Has prefabricated breaking lines which make installing easier, quicker and safer. A flattened bonding wire in contact with the underside of each convolution of the armor assures a permanent low resistance of armor.



SYNTHOL BUILDING WIRE-TYPE TW

For both wet and dry locations. Insulated with a special, tough thermoplastic compound. High dielectric and mechanical strength. Smallest outside diameter for same conductor size permits more or larger conductors in same space.



ENDURITE BUILDING WIRE-TYPE RH-RW

A dual purpose wire, for either dry or wet locations. Type RH has a greater carrying capacity because of higher permissible operating temperature, which allows use of smaller size cable at less cost.



IMPERVEX TRENCHWIRE-TYPE USE-RR

Single conductors for direct earth burial. Has a heavy Neoprene jacket over the rubber insulation. Provides low cost, permanent underground cable installation.



STEEL TAPED PARKWAY CABLE

Designed for direct earth installation without additional protection. All standard types regularly supplied and special type cables made to customers' specifications.



IMPERIAL PORTABLE POWER CABLE

Illustration shows Type SH-D 5000 Bolt Trailing Cable for supplying power to electric shovels, dredges, etc. Covered with extremely tough Neoprene jacket.



CRESFLEX

Most suitable, lowest cost for rural, residential and farm buildings. Clean, gray paint finish.



SERVICE CABLES-TYPE SE

Both Style A (armored) and Style U (unarmored) are approved by Underwriters Laboratories as service entrance cable and may be run down the side of a building without additional protection. It is tamper-proof, flexible and lightweight, moisture-resistant and flame-retarding.



IMPERVEX TRENCHABLE-TYPE USE-RR

Multiple conductor Neoprene jacketed cable for direct burial in the earth. Highly resistant to earth acids, alkali and ground water.



NEOPRENE CRESCORD

Heavy duty, oil-proof portable cord, Underwriters' Laboratories Type SO.



FLEXIBLE STEEL CONDUIT

Underwriters' Laboratories Standard.



VARNISHED CAMBRIC LEAD ENCASED CABLE

Varnished cambric insulation has high dielectric strength and long life. Not affected by oils and greases. This cable is supplied with lead sheath for wet locations or weatherproof braid for dry locations.

CRESCENT INSULATED WIRE & CABLE CO.

ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1954



Furnas Electric DRUM CONTROLLERS Exclusive on BUDGIT HOISTS FOR 14 YEARS

THE REVERSING DRUM CONTROL YOU SEE HERE was designed by Furnas Electric for the Shaw-Box Crane and Hoist Division of Manning, Maxwell & Moore, Inc., of Muskegon, Mich. After 14 years of service on muscle-saving Budgit hoists, the smooth responsiveness and durability of this switch is proved beyond question. Finger-tip control allows one hand to control the load while the other guides it. The controller is a modification of standard design.

You'll find a Furnas Electric controller and starter designed to fit your particular requirements. Control types include multi-speed, magnetic or cam. Ratings 1-10 hp, 110 to 550 volts. And you can select from the widest range of magnetic starters in the 1-50 hp range on the market today. In-between sizes save you money and space.

For more facts or Bulletin 48B describing drum controllers,

get in touch with your nearby Furnas Electric representative. Or write Furnas Electric Company, 1067 McKee Street, Batavia, Ill.







CEILING OF LIGHT in new Ford Pavilion, State Fair Grounds, Detroit, lights open permanent showroom of Greater Detroit Ford Dealers. Cold cathode lamps, 22 in. on centers, are arranged in 19 circles around center column which supports 100-foot wide hexagon framework, provide average of 76 footcandles.

metal channels attached to the bottom of these I-beams provide the only support used for the fluorescent tubing which forms this ceiling of light,

A total of 3600 feet of 20-mm cold cathode lamps are used to form 19 circles of color tubing which encircle the center column in the hexagonal pattern. These circles of lamps are 22 inches apart. Beginning at the outside of the perimeter the 19 color rows are arranged: one blue, eight 3500° white, and one blue.

The lamps are operated at 120 ma by 62 Acme Electric high power factor cold cathode transformers. Twelve of these operate at 12,000-volts secondary, 38 at 9,000-volts, and 12 at 7,500-volts. An average intensity of 76 footcandles of illumination results over the entire display area.

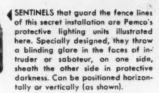
This pavilion, the only building of its kind in the United States, was designed by O'Dell, Hewlett & Luckenbach, architects. Thomas Vanadia & Company, Detroit, designed and engineered the ceiling of light installation.

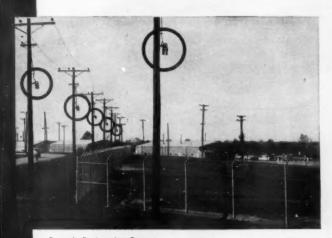


DROPPED CEILING sections in offices of Wayne-Hummer & Co., Chicago brokerage firm, called for a lighting installation combining both surface-mounted and recessed 2-lamp Solar Dean 1260 commercial fluorescent fixtures with row-to-row spacing ranging from $3\frac{1}{2}$ to 5 ft. Cool white 40WT17 lamps, with 40-degree crosswise and 35-degree longitudinal shielding, furnished 40 fc on all working surfaces a month after installation.



LIGHTS MILES of HIGHWAY, FENCE and PARKING AREAS with Cemco LUMINAIRES



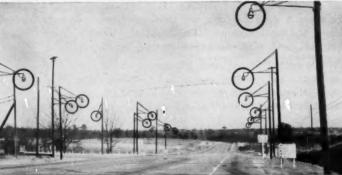


INTERIOR ROADS at Savannah River are lit by Pemco's modern street lighting units (shown here with special-built fire alarm indicator). Pemco luminaires conform to E.E.I. NEMA standards, and as a result of Pemco pioneering through the years in the field of exterior lighting, offer efficient, low-cost operation combined with maximum flexibility.

Pemco was privileged to work on the entire lighting plan for this vast Savannah River establishment in conjunction with du Pont Company engineers.

Pemco's Engineering Department will be pleased to help you with your lighting problem. Also available is the Pemco Catalog of Lighting Equipment No. 90.

Write for your copy — no obligation!



PHILADELPHIA ELECTRICAL & MFG. CO.
1200 NORTH 31st ST., PHILA. 21, PA.

America's Pioneer Street Lighting Manufacturer Still under its original name Offices in Principal Cities







NEMA C-flange meter



Vertical NEMA C-flange motor

In The News

Talk Home Rewiring At Tenth A.W. Conference

A new awareness of inadequate wiring problems in both new and old homes was evident at the Tenth Annual Adequate Wiring Conference held in Chicago last month. More than 300 representatives of electrical groups from throughout the Nation attended the two-day meeting to compare notes on promotional plans and blueprint future actions. All received a much broader conception of the national wiring picture and the critical wiring bottleneck facing the electrical industry today. They acknowledged that, unless something is done fairly soon to get more circuits and capacity into the nation's living quarters the future will be even more bleak.

Keynote speaker Walker L. Cisler, president, Detroit Edison Co., pointed out that we of the electrical industry "have the responsibility of assuring that wiring installed today is adequate not only for all the uses that are possible and probable today, but for the future when double or triple consumption may be commonplace." And that approach is by no means farfetched. Consider a few statistics Cisler gave: Production of electric energy increased from 222.5 billion kilowatthours in 1945 to 442.2 billion kilowatthours in 1954. Based on capability forecasts. production of electric energy can be expected to exceed 1.500 billion kwhrs by 1975. Cisler estimated that some 700 billion feet of wire must be installed throughout the nation to utilize this added electrical capacity—a rough idea of what the industry and the electrical contractor faces in the future. And the contractor is in a key position because he "is almost the final salesman in any wiring job", Cisler stated.

Credit for the present national awareness of inadequate wiring was given to the room air conditioner by M. E. Skinner, vice president, Union Electric Co., St. Louis. He acknowledged that more and more people in the electrical industry are now recognizing the need to sell wiring as a basis for selling additional electrical appliances. "The more things we want to do electrically, the more wiring we must provide to do those things satisfactorily and conveniently", he stated adding that regardless of what segment of the industry engages your attention "nothing happens until wiring is provided so Mrs. John Q. Public can enjoy some more Electrical Living." Skinner urged those present to "sell wiring with the appliance, get out and sell wiring at all times."

Only 17% of the 50 million residences now in existence were built within the past 10 years, Frances K. Legas, Society of Residential Appraisers, told the conference. Progress of the electrical industry has made every home over 10 years old a prospect for electrical overhauling not only for convenience and efficiency butabove all-for safety. Miss Legas urged the development of a national program for rewiring old residences in line with local codes and wiring standards; noted that from an appraiser's viewpoint, capacity of electrical service, wire size and number of circuits are much more significant than number of outlets.

Numerous approaches to the home rewiring market were discussed at



NECA EXECUTIVES at the Tenth Annual Adequate Wiring Conference in Chicago included president D. B. Clayton, Sr. (right), Birmingham, Ala., and Lyle N. Foster, Peoria, III., vice-chairman of the NECA Business Development Committee.

the sessions. From the standpoint of pure promotional and customer appeal, Olive P. Gately, vice president, Fuller & Smith & Ross, Inc., suggested selling a "Packaged Circuit"—something tangible that can be seen and priced and its advantages appreciated. This could apply also to service entrance—a plan now being tried in the Chicago area.

Probably most popular among electrical contractors is the "pay-as-yougo" rewiring plan usually operated by a local electrical group or utility. Under this program, the contractor negotiates the job direct with the customer. A bank, other financial institution or the utility finances the wiring. The contractor is paid in full upon completion of the job and the customer pays off the note in monthly installments to the financing agency.

Cincinnati has had such a time payment plan in operation for the past four months, reported Frank E. Wiatt. assistant manager, electric sales department, Cincinnati Gas & Electric Company. As of Feb. 25, some 77 electrical contractors installed 159 accepted jobs totaling \$35,378. Cost of individual installations ranged from \$40 to \$650 with an average of \$222. Maximum number of jobs accepted from a single contractor to date was 10. To cut red tape, C G & E operates and finances the plan for the convenience of the home owner. Credit is based on the customer's past record of electric bill payment. Procedure is simple. The contractor and owner agree on work to be done. The owner executes a note to the contractor covering contract price. The contractor endorses the note, without recourse,



CONTRACTOR TRIO from Milwaukee compiled notes during session break at Adequate Wiring Conference in Chicago. W. D. Vincent, B. H. Barg and E. H. Herzberg, manager, Milwaukee Chapter, NECA, catalog ideas to take back home.

SAVE TIME...CUT COSTS... BUILD PROFITS...with

COOLER Live

Many cities today require permits and a check by a qualified electrical contractor for sufficient line voltage before allowing the installation of a room air conditioner. This means that an ever-increasing number of electrical contractors are installing air conditioners in hotels, motels, apartment buildings, large and small businesses, and office buildings. These contractors have found that they save the most time—and make the largest profit—when they sell and install COOLER-AIRE room air conditioners.



A COOLER-AIRE MODEL TO SOLVE ANY ROOM AIR CONDITIONING PROBLEM



There's a COOLER-AIRE model designed to provide an ideal solution to air conditioning problems in any room in any building— $\frac{1}{2}$, $\frac{3}{4}$, and 1 ton models. They circulate fresh air, remove stale air, dust and odors. They are easy to install and easy to operate with their new simplified control system that includes a positive-acting thermostatic control for exact temperature regulation.

COOLER-AIRE CASEMENT MODEL

The COOLER-AIRE line includes a special ½ H.P. casement window model that is designed for easy installation in casement windows and other "difficult" locations. The casement model COOLER-AIRE is unusually adaptable as it can be moved from room to room as needed and reinstalled in a few minutes.

See ... your Electrical Wholesaler today...
or fill in this coupon and mail direct to Cooler-Aire

COOLER-AIRE: GENERAL OFFICES 4841-45 NORTH ELSTON AVE., CHICAGO 30, ILL.

Please	send	information	about	the	complete	line	of
COOLE	R-AIRE	room air con	ditione	rs.			

Name.			 *	* 1							 	×	 	×				8	· ×						×	*			
Compa	ny.				*			*	*						Ti	11	e			*						*		*	
Addres	١			 	*	* 1			6		 .6					*			*	*		*		*	×	8 1		*	*

EDOLER Lire

General Offices 4845 North Elston Avenue Chicago 30, Illinois to C G & E. When work is finished and inspection certificate is issued, C G & E pays the contractor in full and the homeowner pays the monthly installments to the utility as part of the regular electric bill. Minimum monthly payment for wiring is \$2.00.

Can an individual contractor organize and operate a program of this type? Will it pay off? The answer, given by F. D. Schooler, treasurer, Alber Electric Co., Inc., Kansas City, Mo., is a very definite "Yes." The formula: a sound organization, faith in one's ideas, advertising, and the willingness to invest a substantial bit of capital.

A few years back, Alber decided to go after residential electrical modernization work in a big way. It organized a separate department and put into service its first mobile van unita one-ton delivery type van truck equipped with some 77 parts drawers, racks, materials and tools to do almost any type of residential repair job. A competent, uniformed, driver-electri-cian operated the unit. The company backed a \$100,000 investment in this experiment with a concentrated advertising campaign to influence the buying habits of the small consumer. And it paid off. Today, Schooler reported, 12 mobile vans controlled by a central "dispatcher" operate in the Kansas City area and are doing a bang-up job.

Alber's goal, according to Schooler, is to develop a direct mail list of some 125,000 desirable residential prospects in greater Kansas City. The new advertising will emphasize the need for electrical modernization especially in homes built more than 10 years ago plus the ease of financing work on a time payment plan. Latest addition to the Alber program is an arrangement with a bank to finance such work under FHA Title I loans with little or no cash down and up to 36 months for payment.

Farmstead rewiring is another substantial market waiting to be tapped. A potential of \$2 billion of electrical modernization awaits the electrical contractor in the nation's 5 million wired farms, H. H. Watson, chairman, NEMA Farm Wiring Committee told the conference.

As usual, there was some discussion about the apparent lack of interest in the AW program by electrical contractors. To prevent this Harry De Poy, manager, Central Iowa Adequate Wiring Bureau, Cedar Rapids, offered sound advice: Don't bypass the electrical contractor. Provide AW layouts and personnel to sell adequate wiring to the contractor's customers. "Call on your electrical contractors regularly. Do all you can to help him and he will help you," he suggested.



ONAN *Emergency* Electric Plant

The homes you help build become unlivable and even unsafe when storms, floods or other disasters interrupt electric power.

Suburban homes are especially vulnerable because of their complete dependence upon electricity. When power interruptions occur, these homes are without heat, water, refrigeration and lights. Freezeups and food spoilage can cause severe losses; fire hazards are increased.

A low-cost Onan Emergency Electric Plant is insurance against power interruptions. When they do occur, the Onan plant supplies regular 115-volt A.C. electricity for all essential uses as long as the emergency exists. Automatic controls start the Onan unit when power fails and stop it when power is restored, protecting the home at night or when the family is away.

Very little space is required for installation in basement or garage. Hook-up to the wiring system is simple. Write today for information on dealership and folder describing Onan Standby Electric Plants...gasoline-driven, 1,000 to 50,000 watts A.C.

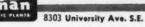
PROVIDES ELECTRIC POWER FOR THESE ESSENTIAL USES-



1. Automatic oil, gas or coal furnaces. 2. Electric water system. 3. Home freezer and refrigerator. 4. Lights, radio, etc. 5. Electric range (limited use). 6. Water heater.

Write for Standby Power Folder

D. W. ONAN & SONS INC.



Minneapolis 14, Minnesota

BUSINESS, LEGAL and ETHICAL PHASES of ENGINEERING

Just Published-2nd Edition

overs business and legal factors the angineer and outracter needs to know about, to soundly relate usiness and technical institers, to round out his socialised background, and to handle managerial roblems. Explains business organization, financial sports, contracts, sales and sales agreements, pa-rints, insurance, codes of professional conduct, etc. orts, contracts, usies and sales agreements, pa-ss, insurance, codes of professional conduct, etc. to-date Second Edition expanded to help you in field of engineering, 89 Donald T. Canfield and H. Bowman, Profs. of Elec. pr., Purdue Univ. 2nd Ed. 365 12 Illus., \$6.00

ELECTRICAL DRAFTING and DESIGN

Gives sound, simple methods proved most efficient and econom-ical in drafting rooms where elec-trical jobs are done. Discussion r

trical jobs are done. Discussion ranges from a fundamentals as symbols and drafting tools worked out examples and drafting tools—10 worked out examples of problem solutions for switchboards, house wiring outdoor substations, machine shop wiring layouts, general lighting, and circuits for industrial plants. By C. Calvin Bishop. 3rd ed., 267 pp., 128 Hiss., 99 tables, 9 charts, \$4.50

ELECTRICAL ESTIMATING

Gives information you need to estimate costs on any electrical construction job. Covers everything from selection and training of electrical estimators and proper use of estimating tools, to cost of preliminary estimates and preparation of final bid sheets. Disuses estimating forms, tools, study of plans and ecifications, listing and checking material quanti-ties, checking completed estimates,

etc. Sample estimates of actual construction costs make this book a "must." By Ray Ashley, 307 pp. Over 190 charts and photographs. \$8.00

ELECTRICAL APPLIANCE SERVICING

Gives principles, tested methods and techniques, and practical servicing instructions for all who want to gain an expert knowledge and ability to service and repair any kind of household electrical appliances. Supplies step-by-step guidance on elecappriances, Supplies step-by-step guidance on electrical and mechanical fundamentais, and repair methods for residence heating appliances, motor driven appliances, and refrigeration and air conditioning units. By William H. Creuse, 854 pp., 727 illus. \$9.00

- SEE THESE BOOKS 10 DAYS FREE---McGRAW-HILL BOOK CO.

330 W. 42 St., NYC 36

Send me the book(s) checked below for 10 days' examination on approval. In 10 days' I will remit for book(s) I keep, plus few cents for delivery, and return unwanted book(s) postpaid. (We pay feelivery if you remit with this coupon; same return

Drivinge.]

Canfield & Bowman—BUSINESS, LEGAL & ETHICAL PHASES OF ENGRNG.—\$6.00

Bishop—ELECTRICAL DRAFTING AND DE31GN—\$4.50

Ashley—ELECTRICAL ESTIMATING—\$8.00

Crouse—ELECTRICAL APP. SERV.—\$9.00

(Print) Name Address

REA Work Shifts To Line Improvements

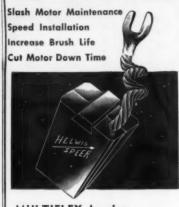
With 95% of the nation's farms having electricity available by the end of 1954, the backbone of the REA network of transmission and distribution lines will be practically completed. From here on out work in the electric power division will be concentrated on line and system improvements-new tie-lines, heavier conductors, additional load centers and substations and conversions from single to three phase. That was the picture members of the Power and Communication Contractors Association received at their Ninth Annual Convention in Chicago.

According to Roy G. Zook, acting assistant REA administrator, approximately 70,000 miles of new lines remain to be built based on loans already made. Of this total, about 40 to 45 thousand miles of line are scheduled to be energized this year-compared to some 51,000 miles in 1953. On the other hand, system improvement work has jumped from 2,000 to 4,000 miles annually during the past three years and is expected to increase this year.

Since availability of work will now be based on the requirements of operating systems, rather than new lines. Zook suggested that contractors keep in close touch with the cooperatives and organize their crews to operate on an area basis to do line extension and maintenance work. It may require some salesmanship on part of contractors to get this work, he warned. However, the one bright spot is that REA borrowers are learning that it is less costly to have contractors do their work than to maintain their own construction crews.

While REA's electric line construction is tapering off, its telephone construction program is just beginning to roll. Loans for rural telephone work are expected to reach \$74 million for fiscal 1954 and an estimated \$75 million for fiscal 1955, according to J. K. O'Shaughnessy, acting assistant REA administrator for the telephone construction program. To date, . some \$154 millions in loans have been approved for this program but only \$461 millions have been advanced so far. Most of the unadvanced funds have been held up because of delivery delays in central office equipment.

O'Shaughnessy had some good news for PCCA members. Telephone work will be done on contract, with contractors furnishing all labor and materials. Experience with some borrowers who used force account work and purchased materials was unsatisfactory as well as being more costly, he noted.



MULTIFLEX brushes with NEOPRENE pads

. really protect your motor and generator investments. Engineered for better contact and reduced vibrations, Helwig Multiflex brushes eliminate uneven wear and reduce circulating current. Get multiple brush operation without expensive changes. The key to longer commutator life is a quality brush designed to FIT, instead of a cut-down, so-called standard brush. Save production time and money with Helwig tailor-made brushes. Write for details on the Helwig brush inventory control plan.

HELWIG CO. 2502 N. 30th Street Milwaukee, Wisconsin



Other POWERCRAFT Products

- Bus Clamps, Power Connectors
 Pipe Frame Fittings for 11/4" I.P.S.
- Indoor and Outdoor Bus Supports

DISCONNECTING **SWITCHES**

5

Hook-Stick Operated by

POWERCRAFT

MEET N.E.M.A. STANDARDS

Powercraft disconnects are built of bus bar copper for uniformly high conductivity in the current carrying path. Silver ball contacts assure low temperature rise. Simple, firm locks.

· New catalog just off the press. Write for your copy. A few territories open to qualified nanufacturers' agents.

POWERCRAFT CORPORATION

2215 DeKalb St., St. Louis 4, Mo. Phone PRospect 4532 Since 1932



Pictured are the answers to two common electrical grounding problems solved by CADWELD.

The main illustration shows a permanent CADWELD grounding installation using copper bar in place of cable. The insert shows how the same CADWELD connection was employed where a disconnect type grounding system was required. The disconnect system is specified where periodic resistance checks are taken of individual ground rods.

WITH CADWELD

- 1. Copper bar or cable can be permanently welded to copperweld or steel ground rods.
- 2. Copper bar can be joined flat (as illustrated) or on edge.
- 3. Length and drilling of disconnect lug can be varied and scrap copper bar can be used.
- 4. Connections cannot loosen or corrode.
- 5. Equipment is portable—IDEAL for field use—no outside source of power or heat required.

For the best in ELECTRICAL CONNECTIONS







FLOODLIGHTS

OPEN AND ENCLOSED WEATHERPROOF TYPES WITH RANGE OF QUALITY AND BEAM SPREADS TO COVER ANY FLOOD-LIGHTING NEED.

Latest in design to meet the most exacting lighting requirements.

A variety of beam spreads for all applications.

SERIES A

750-1500W

SERIES Y 750-1500W

A low cost unit to meet minimum standards. Highly efficient and with a wide angle distribution to fit any need.

> Both units available in Siip Fitter, Wall, Pipe and Cross Arm mountings

SPERO diso makes "GUARANTEED" PORCELAIN ENAMEL REFLECTORS...FLOODLIGHTS...VAPORTIGHT UNITS...INSULATORS...SWITCHPLATES

THE SPERO ELECTRIC CORPORATION 20500 St. Clair • Cleveland 17 Ohia

Two big problems face the telephone program, O'Shaughnessy revealed. Long delivery delays on central office equipment are dragging out installation progress. Lax engineering on part of consultants with inaccurate cable and material quantities complicates the problem of getting estimates from contractors. While private companies are getting their central office equipment within a month or two, REA borrowers must wait 12 to 24 months, he noted. Unless this situation is rectified in the near future, O'Shaughnessy flatly stated that REA would go into the foreign market for help.

To combat the engineering deficiency REA is conducting a number of engineering schools using retired telephone engineers as instructors. Latest one in session has some 100 engineers enrolled from 50 consulting engineering firms.

One significant point was revealed during O'Shaughnessy's discussion. He reported that since REA started the telephone program a number of Bell System companies are letting their construction work out on contract. He sees this as a new industry trend.

R. F. Clifton, Three Rivers, Michigan, was elected PCCA president at the concluding business session. T. L. Trawick, Victory Electric Co., Mobile, Ala., became ex-officio member of the official group following his retirement as president. Other officers chosen at the meeting include: first vice president—Don Ward, Early, Iowa; second vice president—Paul Wallack, Tulsa, Oklahoma; third vice president—E. C. Bridges, Heath Springs, S. C.

Frederick P. Goffey

Frederick P. Coffey, president and treasurer of Anderson-Coffey Company, Inc., Boston, Mass., died on March 17 after a brief illness. He was 57 and lived at 98 Moss Hill Road, Jamaica Plain, Mass.

Mr. Coffey was born in Everett and served in the Navy during World War I. He was president of the Engineers Club, past president of the Massachusetts Building Conference, the Electrical Institute of Boston and the Greater Boston Electrical Contractors Association, and a member of the Algonquin Club and the National Electrical Contractors Association. He served on the NECA Line Constructors Committee.

He leaves his wife, Marion; a son, Frederick, Jr.; and two daughters, Mrs. John Scott of Marblehead and Joan Coffey.

NISA News

New York Metropolitan Chapter had a meeting on February 18th at the Hotel Shelburne. Milt Volker was principal speaker on the subject of Carbon Brushes and their applications.

There were 40 present at the February meeting of the Quaker City Chapter. The ever-puzzling problems of the Penna. Sales Tax as applied to our type of operation got a pretty good going-over, and a Committee consisting of C. R. Durand, Alex Wenger and Jack Persson were given the job of trying to find the answers.

Another idea was brought up that we feel has an important relation to our problem of employee training. This was the idea of having a course on motor repairing and plant maintenance set up in the various Vocational Schools, with the active participation of our shops in providing facilities for actual practical training. This has already been done in some localities—one nearby is the Allentown, Bethlehem area.

The New England Chapter held its regular meeting at the Hotel Bradford on February 11th. The meeting was called to order by Pres. Ed. Kolhonen. Ed introduced guests and several members who had not been seen for some time. Arthur Glines reported the progress of the March Foreman's meeting.

Northwest-Central Ohio Chapter met February 6th in the Chestnut Room of the Hotel Secor in Toledo for lunch, following which the group went to the office of the Fred W. Kiemle Co. for a business meeting. Charles Smith of Great Lakes Chapter told the group of plans for the coming National Convention in Detroit.

Chapters in Region 7 and the Indiana Chapter met February 19-20 in Cincinnati at the Cincinnati Club. Friday morning, February 19th, was devoted to shop visits and registration with the meeting opening officially at 12:30 PM for luncheon. The afternon session was devoted to business topics and the evening to a banquet. The Saturday morning session was set aside for discussion of shop topics, followed by cocktails and luncheon.

The sessions included talks by Dallas Meyer of Dow Corning on insulation treatments and E. F. Greiwe of Allis-Chalmers on suggestions for handling new NEMA rerated designs.

King Coal Chapter held its regular quarterly meeting January 28th at Evansville, Ind. with Flanders Electric Motor Service, Evansville, as host. The group also visited Swanson-Nunn



Snap!... There's another fellow trapped by high costs! Easy to avoid. Just order Circle F! No high prices there – Just top quality Guaranteed Wiring Devices at an easy-on-the-pocket price. Send for our catalog No. 18 and see for yourself. Order Circle F... and save!



Bakelite Pull Receptacle. Combination 31/4" - 4". Three piece-Shadeholder Groove. Open double terminals for continuous wiring. 250W-250V



202-0

Bakelite Keyless outlet box receptacle. Combination 31/4"-4". Flush back -Open double terminals for continuous wiring -Shadeholder Groove 660W-250V



212-0

Porcelain Keyless outlet box receptacle. Open terminals. Flush back with Shadeholder Groove. 660 watts-250 volts. Supplied with drain holes to meet R.E.A. specifications. For 3¼" or 4" box.



864-50

Porcelain Pull Receptacle. Convenience outlet in base and Shadeholder Groove. 250 watts-250 volts. For 31/4" or 4" box. Available with pendant or insulator.

Circle F Mfg. Co.



TRENTON 4, N. J.

Saving You More Since 1904

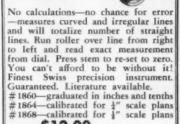
ELECTRICAL CONSTRUCTION AND MAINTENANCE . . . APRIL, 1954



Especially Calibrated . . Indispensable

For

- · CONTRACTORS
- . ARCHITECTS
- . ENGINEERS



\$12.00 post paid
Order direct or through your dealer.

Special LITTLE JEWEL

Smallest, most efficient, accurate megohmeter ever made. Fully guaranteed. Little Jewel Only \$75.00 Write for full particulars.

R. A. KOENEMAN CO. 1408 Delmar Blvd., St. Louis 3, Mo.



You can automatically:

Stop, start mechanism, flow, travel, etc.!

Weigh, measure, inspect, sort, direct, signal!

Open, close doors, switches! Stop, announce or trap intruders!

Stop fire before it spreads! Regulate combustion!

Put your problem up to Worner electronic engineers. Their recommendations will enable you to install Worner packaged units as used throughout in dustry. Address or phone our engineering department for recommendations.

WORNER

Rankin 3, Illinois • Phone Rankin 55

Electric Co., Evansville, where extensive shop alterations were recently completed.

Next meeting is scheduled in April at the Kentucky Lake lodge of C. W. Nunn, Swanson-Nunn Electric Co., south of Paducah, Ky.

"Brush Up On Brushes" was the title of the Central District Chapter February 9th meeting, held at Chicago's Tower Club. Following dinner, representatives of the Helwig Co. in Milwaukee discussed brush production from raw material to finished product as well as special applications. Also discussed was shop labor turnover.

R. A. Scherer, president of NISA in 1952-53 became NISA's first Privileged member last month when his application for the new Association membership classification was approved.

The Privileged member category was approved by the December vote of the membership per Art. III, Sec 1(c) of NISA's By-Laws. It provides a means for retired members to maintain contacts with the industry and NISA. Privileged members in general have all rights and privileges of Active members with the exception of voting and holding office.

Rudy Scherer has long been active in NISA affairs and until his recent retirement was an owner of the Scherer Electric Co., Indianapolis.

Privileged members are persons no longer actively engaged in the electrical repair business who had represented firms who were members of NISA for at least 10 years.

Any retired NISA member who is eligible for Privileged membership is urged to write National Headquarters for an application blank. Active members are also requested to send in names of candidates to whom they wish blanks to be mailed.

One of World War II's most famous spies, Countess Maria Pulaski, will relate some of her experiences as a member of the British Intelligence Service at the June 14th luncheon during NISA's 21st Annual Convention in Detroit.

. . .

In Poland at the time of the Nazi invasion, Countess Pulaski escaped to England where she became an allied spy, serving in Berlin during the final attack which ended German resistance.

The title of the Countess' talk will be "My Life As a Spy" which is also the tentative title of a forthcoming motion picture she will make in Hollywood following her speaking tour.

Foshee Electric Co., Fort Worth, Tex., recently underwent a complete remodeling of its shop and office. Carl Pons Electrical Co., Shreveport, La. moved recently into its new modern shop quarters at 3538 Mansfield Road. Owner Carl Pons has issued a blanket invitation to NISA members to visit the new building which has been described by members in the vicinity as being designed for "maximum efficiency and beauty."

Shreveport Armature & Electric Works, Inc. Shreveport, La. has modernized its shop and offices and purchased some new machinery. Gus R. Lieber is the owner of the firm.

. . . .

Contractors Study Lighting at Nela Park

Electrical contractors from all parts of the U.S., except the Pacific coast, attended a two-day conference January 18-19, 1954 held by General Electric at its Lighting Institute at Nela Park. The meeting was attended by 43 individuals, representing some 30 firms. It involved numerous sessions, and was devoted to planning and maintenance of lighting systems.

Featured speaker at the conference was Erne C. Carlson, president of Carlson Electric Company, Youngstown, Ohio, and chairman of NECA's Labor Relations Committee. In his address, Carlson described the extent of the market opportunity in the fields of office, store, school, and industrial lighting. He pointed out that a \$6-billion potential in relighting offices and stores and in lighting new schools awaits the electrical contractor. He urged that the contractor aggressively sell lighting and its benefits.

It was revealed at the conference that both the incandescent lamp and electrical contractors are this year celebrating their Diamond Jubilees.

Walter W. Becky and Frank B. Lee of the G. E. Lamp Division's Sales Department served as chairmen.



ELECTRICAL REPAIRS and sales and other activities of the New Orleans Armature Works, New Orleans, La., are under the firm guiding hand of Charles W. Hiers, president.



Ohio Edison Company, Niles Station . Hatzel & Buehler-Electrical Contractors

over 21/2 miles of Cope Cable Trough

... has been installed in the Ohio Edison Company's new 212,000 kw. steam station at Niles, Ohio, to carry both auxiliary power and control circuits throughout this gigantic structure. All circuits are readily available for maintenance, and sufficient trough area remains for additional cables necessary for future expansion.

The simplification of design through the use of standard parts, plus the ease of installation and the low installed cost, make possible many savings which may be obtained through using COPE Cable Trough.

For further information, write today for Bulletin 4M.

You know Cope by these products





T. J. COPE, INC.

711 SOUTH 50th ST., PHILADELPHIA 43, PA



THIEL

STAPLES (Pat. #2632356)

Engineered to take punishment
. WON'T BEND OR SQUASH
. WON'T SPLIT HARDEST WOOD

Contractors want these strong, rugged flat-top THIEL Staples because they save worry and waste in time and material — they don't have to "baby" them. THIEL Easy-prive-Staples on in straight and true and are the greatest improvement in staples for castles work (metallic and non-metallic) in 25 years. Send for FREE samples—a trial will cenvince anyone.

THIEL EASY-DRIVE "NAIL IT" and THIEL "EASY-ON" STRAPS are another must for electrical

 Sold by Leading Electrical Wholesalers write for information on open territories.

THIEL TOOL AND ENGINEERING COMPANY

1417 North Market Street, St. Louis 6, Missouri



GETS-A-LITE GUARD and GUIDE Quickly and Easily Installed by

- Anyone No Tools Needed!

 Simply slip GETS-A-LITE GUARD AND GUIDE over the fixture, as illustrated.
- Made of indestructible spring steel wire. Nothing to break, get out of order or replace. Will last indefinitely.
- Once installed, GETS-A-LITE GUARD AND GUIDE is NEVER removed.
- AND GUIDE is NEVER removed.
 Nothing to unlock, fuss with or lock, when changing lamps.
- GETS-A-LITE GUARD AND GUIDE actually steers lamp into socket, enabling maintenance man to change lamp in 10 seconds!
- Available for 40 watt and 100 watt fluorescent lamps.

Contact Your Electrical Wholesaler, OR

GETS-A-LITE Company—Dept. EC44

3865 N. Milwaukee Ave., Chicago 41, III.



GROUP LAMP REPLACEMENT is recommended by E. A. Lindsay (left) General Electric Lamp Dept., Nela Park, to E. E. Sterner, electrical engineer, Western Electric, Inc. Indianapolis, Indiana, at Plant Maintenance Conference in Chicago.

DATES AHEAD

Regional Conferences: Southern—
Roosevelt Hotel, New Orleans, La.,
April 8-9; Southwestern—Rice Hotel, Houston, Texas, April 11-13;
Inter-Mountain — Denver, Colo.,
April 15-16; South Pacific Coast—
Museum of Art, San Francisco, April
19-20; Pacific Northwest—Benjamin
Franklin Hotel, Seattle, Wash., April
22-23; Canadian—King Edward Hotel, Toronto, Ont., Canada, April
28-30; Great Lakes—Sheraton-Cadillac Hotel, Detroit, Mich., May 3-4;
Midwestern — Jefferson Hotel, St.
Louis, Mo., June 17-19.

American Society of Tool Engineers' Industrial Exposition — Convention Center, Philadelphia, Pa., April 26-30.

Welding & Allied Industry Exposition
—Sponsored by American Welding
Society, Memorial Auditorium, Buffalo, N. Y., May 5-7.

Electrical Manufacturers Representatives of New England—Trade Show, Mechanics Building, Boston, Mass., May 5-7.

National Fire Protection Association— 58th annual meeting, Statler Hotel, Washington, D. C., May 17-21.

Edison Electric Institute—Annual convention, Atlantic City, N. J., June 1-3.
National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., Week of June 6.
National Industrial Service Assn.—

National Industrial Service Assn. — Annual convention, Hotel Statler, Detroit, Mich., June 13-16.

N. Y. State Electrical Contractors and Dealers, Inc. — Annual convention, Saranac Inn., Saranac Inn, N. Y., June 28-July 2.

Western Plant Maintenance Show and Conference — Pan Pacific Auditorium, Los Angeles, Calif., July 13-15. Illuminating Engineering Society —

Illuminating Engineering Society— National Technical Conference, Chalfonte-Haddon Hall, Atlantic City, N. J., September 12-16.

International Association of Electrical Leagues—Bellevue Stratford Hotel, Philadelphia, Pa., September 29-October 2.

National Electronics Conference, Inc.

--Hotel Sherman, Chicago, Ill., October 4-6.

Eastern Canada All Electrical Show— Show-Mart Exhibition Hall, Montreal, Quebec, Canada, October 6-10.

National Electrical Manufacturers Assn.—Haddon Hall Hotel, Atlantic City, N. J., November 8-11.

Among the Manufacturers

Headquarters Announcements

Minneapolis Honeywell Regulator Co., Brown Instruments Div., Philadelphia, Pa.—C. L. Peterson, divisional vice-president; O. B. Wilson, general sales manager.

Yardney Electric Corp., New York, N. Y.—Adm. J. A. Briggs (Ret.), special assistant to the president.

Greibach Instruments Corp., Metuchen, N. J.—a new affiliate of Gulton Mfg. Corp.

Sprague Electric Co., North Adams, Mass.—R. L. Parrish, manager of new plant in West Jefferson, N. C.

J. R. Richards Co., Carnegie, Pa.—Gayle Lewis, vice-president in charge of marketing; G. W. McCall, Jr., sales

General Electric Co., Schenectady, N. Y.—E. C. White, product manager of industrial and transmitting tubes.

Dayton Rubber Co., Dayton, Ohio-J. D. Hershey, director of sales promotion.

Buck Electrical Mfg. Co., Roselle Park, N. J.—Stephen N. Buchanan, president; D. B. Kusiv, vice-president and general manager; J. K. Leeds, secretary-treasurer of this newly formed company which makes a new type of nylon insulated splicing connector called Nycap.

Mitchell Mfg. Co., Chicago, Ill.—two new plants have been added to increase air conditioner production.

Electrical Engineers Equipment Co., Melrose Park, Ill.—C. Christensen, vice-president of engineering.

Reynolds Metals Co., Louisville, Ky.—David P. Reynolds, director.

Bristol Co., Waterbury, Conn.— J. G. Fleming, product planning manager.

Burndy Engineering Co., Inc., Norwalk, Conn.—I. F. Matthysse, assistant chief enginer; W. F. Bonwitt, chief administrative engineer.

Moe Light Div. of Thomas Industries, Fort Atkinson, Wis.—R. W. Minett, sales manager.

Hoover Co., Electric Motor Div., N. Plainfield, N. J.—James M. Adair, sales manager.

Multi-Amp Corp. has moved to new quarters at 10 Third St., Newark, N. J.

Dominion Bull Dog Ltd., Toronto, Ont.—a new susidiary of BullDog Electric Products Co.

Robertson Electric Co., Buffalo, N. Y.—N. R. Wilson, vice-president. Johns-Manville Corp., Transite Pipe Dept., New York, N. Y.—L. F. Frazza, manager of marketing section, Hubbard and Co., Pittsburgh, Pa.— Charles L. Stroup, vice-president of research.

American Gas & Electric Co., New York, N. Y.—E. A. Hengst, treasurer. Federal Electric Products Co., New-

ark, N. J.—W. R. Parshall, director and treasurer.

United States Rubber Co., New York, N. Y.—W. E. Combs, assistant sales manager of mechanical goods.

Pass & Seymour, Inc., Syracuse, N. Y.—R. K. Watkins, sales manager. Corning Glass Works, Technical Products Div., Corning, N. Y.—W. H. Tomb, merchandising manager.

Artisan Metal Works Co., Cleveland, Ohio—D. A. MacRitchie, sales man-

Chester Cable Corp., Chester, N. Y.

—John Lackman, executive technical director.

General Electric Co., Power Transformer Dept., Pittsfield, Mass.—C. T. Kastner, manager of transformer apparatus sales.

Federal Sign & Signal Corp. is the new company name of Federal Enterprises, Inc. R. S. Perry is now a director of the Chicago, Ill. firm.

Mitchell Mfg. Co., Chicago, Ill.— John Bullock, sales manager of air conditioning and high fidelity divisions.

Thomas & Betts Co., Elizabeth, N. J. —M. D. Bergan, engineering technical director.

Okonite Co., Passaic, N. J., has taken over all operations of the Okonite-Callender Cable Co., formerly a subsidiary firm.

Regional Appointments

NEW ENGLAND

Atomic Instrument Co.: H. L. Hoffman & Co., sales representatives for New England, New York, and New Jersey including eastern Pennsylvania.

MIDDLE ATLANTIC

Lancaster Pump & Mfg. Co.: James Annis, N. Y. district manager.

Orangeburg Mfg. Co: T. W. Drennan, district sales manager, New England and Middle Atlantic states.

Admiral Distributors, Inc., contract division: R. M. Schein, supervisor of New York Div.

Miller Co., Illuminating Div.: Adam Heuslein, sales engineer for eastern Pennsylvania and Warren County, N. J.

SOUTH ATLANTIC

Henry L. Crowley & Co.: F. R. Ruppert, sales representative.

Reliable Electric Co.: Montague H. Hicks, sales representative for North Carolina, Virginia and Ohio.

Graybar Electric Co.: L. A. Shaw, manager, Rocky Mount, N. C. branch. Olin Industries Inc., Ramset Fasta new policy...of importance to YOU!

every
Precision
Transforme

now backed by a

5-YEAR GUARANTEE

Protection and assurance you want, need and deserve! It's yours with Precision Transformer's industry-shaking 5-year guarantee! This long-term guarantee is Precision's way of proving complete confidence in the unexcelled dependability of their products. Be protected, be precise—order Precision!

1/4 TO 1000 KVA
VOLTAGES TO 15KV

Write today for FREE Catalog and valuable technical data sheets.



These PTC dependability features are yours:

- Built to exceed latest NEMA stands
 Class "B" insulating materials
- Rugged, long-lasting construction
- · Easy installation and maintenance
- * Efficient, trouble-free service
- Accepted by leading engineers and industries





PRECISION TRANSFORMER CORP. 660 West Grand Ave. • Chicago 10, III. SEeley 8-2740

CHECK IT! ...with the sprague

Adequate Wiring Analyzer

This compact Sprague instrument checks wiring to see if it's adequate for present or contemplated loads.

See the effect of increasing loads on wiring right at the spot! Direct reading meter indicates percentage voltage drop on 115 or 230 volt circuits under load without troublesome calculations,

Con actors for convenience outlets, equipment, panel boards, etc. are furnished—ideal for industrial, utility, and field use.

Write for Bulletin PF-600

SPRAGUE ELECTRIC COMPANY
333 Marshall Street, North Adams, Massachusetts

SPRAGUE

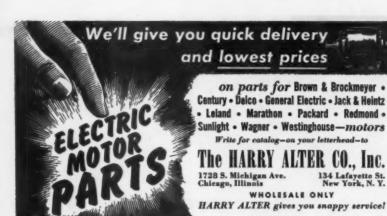
PIONEERS IN ELECTRIC and ELECTRONIC DEVELOPMENT

ne send me free Sprague Bulletin PF600 on the Analyzer.

npany

Iress

Zone State.



If ... You Change Your Address

Be sure to notify us at once so future copies of Electrical Construction and Maintenance will be delivered promptly.

Also make certain you advise your local Post Master, so other important mail doesn't go astray. Both the Post Office and we will thank you for your thoughtfulness.

Send your new and old address to: Subscription Dept.

ELECTRICAL CONSTRUCTION
and MAINTENANCE

330 W. 42nd St.

New York 36, N. Y.



Mourts Mineraliac hangers No. 8 to No. 6 on 1-Bozms safely without nacessity of drilling holes. Made of heavy gauge zinc plated steel with deep drawn ribs to give needed strength, those durable, light weight beam clamps have %-20 tapped holes—will fit beam flenges up to % inch thick. Furnished with case-hardened set screw. Low cost.

Order From Your Electrical Wholesaler SEND FOR LITERATURE

MINERALLAC ELECTRIC COMPANY
25 North Peoria St. Chicago 7, III.

MINERALLAC

WHERE To Buy

Equipment, Materials, Supplies and Services for Electrical Construction— Maintenance—Repairs

STOP that WATER

With FORMULA NO. 640, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in, Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. 33 in 55's. Free sample. See Sweet's. HAYMES PRODUCTS CO. OMAM 3. NERS PRODUCTS CO.

TECHNICAL DATA COMPANY & TRADE NAMES PRODUCT LISTING PRODUCT INFORMATION

You'll find it all in the ELECTRICAL PRODUCTS GUIDE

Issue of Electrical
Construction
And Maintenance

eners Div.: R. E. Mullis, district sales manager for North Carolina, South Carolina and Tennessee.

EAST CENTRAL

Peerless Electric Co., Fan & Blower Div.: J. A. Brainard, sales representative, northeastern Ohio and western Pennsylvania.

Allen-Bradley Co.; Richard Wessling, Chicago district manager.

General Electric Co.: J. E. Nelson, central regional manager of equipment tube sales, Chicago.

Cutler-Hammer, Inc.: J. T. Riday, manager of South Bend, Indiana sales territory, succeeding the late Terry Fisher.

Appleton Electric Co.: H. A. Buegel, district manager, Michigan; R. E. Darby, district manager, Ohio, West Virginia, and portions of adjacent states.

General Electric Co., Apparatus Sales Div.: James M. Olive, manager of sales promotion and advertising.

International Register Co.: D. F. Korb, Cincinnati district sales representative.

National Electric Products Corp.: Edgar M. Perrott, Wisconsin district sales manager.

General Dynamics Corp., Electro Dynamic Motor Generator Div.: H. W. Ellis, midwestern regional man-

Joy Mfg. Co.: H. E. Butters, manager of new Ohio-Michigan sales district with offices in Cleveland.

Belden Mfg. Co.: W. M. Stuart, sales development manager, Chicago.

WEST CENTRAL

Minnesota Mining & Mfg. Co.: R. A. Henderson, Dallas sales manager of electrical products.

Lancaster Pump & Mfg. Co.: R. O. Briggs, Central district manager.

Graybar Electric Co.: R. L. Shuck, manager of a new branch in Springfield, Mo.; R. V. Jenson, manager of new Sioux Falls, S. D. branch.

Appleton Electric Co.: H. T. White, district manager for Kansas, Missouri, Arkansas and adjacent sections of Nebraska, Illinois and Kentucky; W. E. Huskins, district manager of Minnesota, Iowa, North and South Dakota plus nearby parts of Illinois. Wisconsin and Nebraska.

WEST

Koppers Co., Wood Preserving Div.: J. W. Sullivan, manager, Colorado District.

Anaconda Wire & Cable Co.: Albert H. Leader, district manager at Seattle office succeeding Lloyd Wolfe who retired.

R. & J. Dick Co.: new warehouse and office at 5276 Atlantic Boulevard, Maywood, California.

KEY TO LONG RANGE MODERNIZATION

FROM PAGE 93]

units thereby providing gross ratings of 7250 rather than the recommended 5000 kva. It should be noted that this capacity is for 440-volt service only and does not include provisions for lighting or for the service of approximately 4500 hp operating at 2.3 kv.

(7) Relocate or reconnect some of the 2.3-ky operating machinery (including many motors between 150- and 700-hp ratings) so that the load on all primary feeders is approximately equal.

(8) Provide 2½ watts per square foot for the plant generally, with 5w/sq.ft. available for drafting rooms, offices, etc. Lighting requirements are served by local air-cooled indoor 2300-208/120- or 220/110-volt transformers connected either to separate 2.3-kv lighting feeders, or to breakers on the primary side of 2300/440-volt substations.

(9) Check interrupting capacities of all OCBs serving 2.3-kv motors to insure against possible fires or outages due to unchecked overloads.

(10) Install new plug-in busduct, power switches, additional distribution panels and banks of capacitors in several manufacturing areas to provide production flexibility and obtain high overall power factors.

This was, indeed, a giant stride forward, dictated by the studied consideration of existing equipment and system characteristics, anticipated expansion and revision, logical comparison between alternative types of distribution systems and switchgear. No longer are makeshift and stop-gap measures evident for, at the Rome Cable Corporation, practical analysis was the key to long-range moderniza-

Founded in 1936 as an independent manufacturer of electrical wire and cable, the Rome Cable Company has grown steadily and has expanded its product line greatly, necessitating the addition of offices, research laboratories, engineering and testing facilities.

In so doing, net sales have multiplied 30 times, net plant investment has multiplied nine times; employment has gone up 350%, and manufacturing floor space has jumped from 160- to 730-thousand square feet.

Coincidentally, monthly kwh consumption has risen from half a million to 21-million, plant kilowatt demand has steadily climbed from below 1000 to over 3000 and is expected to go to 6000 kw within a decade.

SEARCHLIGHT SECTION

IMPLOYMENT: BUSINESS "OPPORTUNITIES"

USED OR RESALE

11.20 per line, minimum 3 lines. To figure advance payment count 5 average words as a line, payment count 5 average words as a line.

Wented undisplayed rate is one-half of shore site, payable in advance.

San Francisco offices count as one additional line.

Discount of 19 % if full payment is made in advance for 4 consecutive insertions.

New Ads Received by April 21st at the New York office, 330 % 42nd 8t. New York 36, N. Y., will appear in the May Issue subject to limitations of space available.

E.C.M.

REPLIES (Box No.): Address to office nearest you NEW YORK: 330 W. 42nd St. (36) CHICAGO: 520 N. Michigan Ave. (11) SAN FRANCISCO: 88 Post St. (4)

BUSINESS OPPORTUNITY

British chartered electrical, mechanical engineer with downtown consulting offices in Buenos Aires, established 1941, seeks partner-ship or arrangement for handling S. American projects of American consultants, BO-2151 Electrical Construction & Maintenance.

ANYTHING within reason that is wanted in the field of Electrical Construction & Maintenance quickly located through bringing it to the attention of thousands of men whose interest is assured because this is the business paper est is assured because this is the business paper.

FOR SALE ELECTRICAL CONTRACTING BUSINESS

S. E. Florida-Est. 10 years. Specializing selected clientele, maintenance & construction accounts. Moderate investment.

BO-9644, Electrical Construction & Maintenance 330 W. 42 St., New York 36, N. Y.

BOOKS

ELECTRICAL CONTRACTORS ESTIMATING HANDBOOK

"A Unique Tool of the Trade" WRITE FOR DESCRIPTIVE FOLDER TO
THE ESTIMATOR PUBLISHING CO.
4102 Wilson Road Kenesha, Wis.

Your inquiry will have Special value . . .

If you mention this magazine, when writing advertisers. Naturally, the publisher will appreciate it . . . but, more important, it will identify you as one of the men the advertiser wants to reach with this message . . . and help to make possible enlarged future service to you as a reader.



FOR SALE

150 M feet No. 14 AWG. Varnished, Cambric and Lead. Solid Wire, 600 Volt

This wire is new, on 2500 ft. reels and is subject to prior sale FOB. Our warehouse Brooklyn, N. Y.

ACE WIRE & CABLE CORP. 126 Greenpoint Avenue, Brooklyn 22, N. Y. EVergreen 9-1539

NEW LEAD CABLE

FOR SALE

2-1000' Reels 15KV grounded cable, 3conductor, 2/0 stranded (37 strands) Semicon Tape, 19/64" Hazard Key-stone insulation, each conductor taped, copper tape, jute filler, tape, 8/64" lead.

Shipping weight per M feet-9750# Net weight per M feet

GUY F. ATKINSON COMPANY 10 W. Orange Ave., So. San Francisco, Calif.

ELECTRIC WIRE IN STOCK

Overhead, Welding, Asbestos, Elevator, High-voltage Cables,

EASTERN ELECTRIC SALES CO. 8425 Pennegrove St., Phila., Pa. GR-4-5900

Advertising In This Issue

Autor doing in This I
Abolite Lighting Div.
Jones Metal Products Co 224
• Accurate Mfg. Co
Adam Electric Co., Frank
Allen-Bradlev Co
Allis Co., The Louis
• All-Steel Equipment, Inc 23
Alter Co., The Harry
American Brass Co., The American Metal Hose Branch 100
American Steel & Wire
Div. of U. S. Steel Co
Amplex Corp
Appleton Electric Co
Armstrong-Blum Mfg. Co
Arrow-Hart & Hegeman Elec. Co12, 13
Art Metal Co., The 211
Automatic Switch Co
Baldor Electric Co
Belden Manufacturing Co 229
Benjamin Electric Mfg. Co 104
Berns Mfg. Corp. 201 Biddle Co., James G. 181
Blackhawk Mfg. Co 107
Brady Co., W. H
Briegel Method Tool Co
Broan Mfg. Co., Inc
Dunalo Forge Co
BullDog Electric Products Co 109 Burndy Engineering Co
Bussmann Mfg. Co110, 111
Century Electric Co
Champion DeArment Tool Co 172
Circle F Mfg. Co. 245 Coffing Hoist Co. 113
Columbia Cable & Elec. Corp 49
Cooler-Aire, Glass Gorham Co. 240 • Cope, Inc., T. J. 247 Cordley & Hayes 114
Cordley & Hayes
Coming Glass Works
• Crescent Ins. Wire & Cable Co 235 • Crouse-Hinds Co6, 7
• Curtis Lighting, Inc
• Curtis Lighting, Inc
Day-Brite Lighting, Inc
Dossert Mtg. Corp. 734
Du Pont de Nemours & Co., Inc.,
E. I
Economy Fuse & Mfg. Co
Ethiciency Elec & Mira Co. 170
Electric Service Mfg. Co 203
Electric Storage Battery Co., The
Electio Dynamic Div. or
General Dynamics Corp
• Electro Silv-A-King Corp
Fairbanks, Morse & Co
• Federal Electric Products Co 15
• Feedrail Corp. 119 Fullman Mfg. Co. 207
Furnas Electric Co
G&W Electric Specialty Co 122
• Garden City Plating & Mfg. Co 121
General Cable Corp
Apparatus Sales Div Second Cover
 General Electric Co. Apparatus Sales Div Second Cover 10, 36, 171, 190, 191 Construction Materials Div. Fourth Cover
60, 182
Distribution Assemblies Dept 173
Lamp Div
• Graybar Electric Co., Inc. 62, 99, 161, 166
Greenlee Tool Co 124

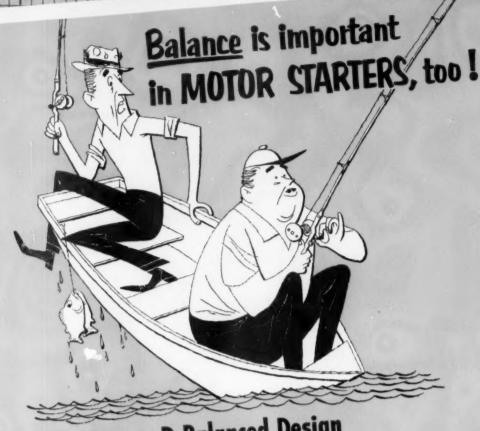
/040	_
Cuth Co. The Edwin E	196
Guth Co., The Edwin F Havnes Products Co.	250
Haynes Products Co. Hazard Insulated Wire Works 27, Helwig Co. Hope Electrical Products Co	32
Helwig Co	242
Hope Electrical Products Co	126
Hubbell, Inc., Harvey Ideal Industries, Inc	125
Ideal Industries, Inc Ilg Electric Ventilating Co.	129
Industrial Engineering Equipment	226
Ing Electric Ventilating Co	25
• Jackson Electrical Co	226
• Johns-Manville	175
Joy Manufacturing Co	210
Kalamazoo Tank & Silo Co	228
Kalamazoo Tank & Silo Co	216
Klein & Sons, Mathias	226 246
Koenemann Co., R. A.	50
Leviton Mfg. Co Litecontrol Corp	128
A McCill Mig Co Inc	48
McGraw-Hill Book Co	242
Mercoid Corp., The	130
McGraw-Hill Book Co. Mercoid Corp., The Midwest Electric Mfg. Co. Minerallac Electric Co.	250
Moioney Electric Company	30
Morrison Steel Products, Inc	194
Multi Electric Mfg. Inc	131
National Electric Prods. Corp.	133
Nelson Elec. Mfg. Co	208
National Carbon Co National Electric Prods. Corp. Nelson Elec. Mfg. Co Newman Industries (America) Inc	51
Okonite Co., The	32 241
Orangeburg Mfg. Co., Inc.	134
Oster Mfg. Co., The	40
O. Z. Electrical Mfg. Co., Inc	136
• Parr Electric Co., Inc.	202
Parr Electric Co., Inc. Pass & Seymour, Inc. 77, Phelps Dodge Copper Products	135
Corp46,	71/
Corp	237
Pittsburgh Reflector Co	215
Plastic Wire & Cable Corp	139
Porcelain Products Inc.	209
Powder Power Tool Corp. Powercraft Corp. Precision Transformer Corp. Puls Missingle Corp. The Missingle Corp.	177
Precision Transformer Corp.	249
ryle-National Co., The	230
Pyramid Instrument Corp	35
Ramset Fasteners Inc.	180
Remington Arms Co., Inc.	199
Republic Steel Corp150,	151
Red Wing Shoe Co. Remington Arms Co., Inc. Republic Steel Corp	138
Ridge Tool Co., The	193
Roebling's Sons Co., John A	223
- Atomic Capit Conference of the Conference of t	4
Royal Electric Co., Inc	225
• Russell & Stoll Co., Inc	170
FIFFTRIPAL	

S&C Floatrio Co	9
S&C Electric Co	205
Sangamo Electric Co171, 207,	
Scherr Co., Inc., George	228
Sherman Mfg. Co., H. B	214
Sherman Mfg. Co., H. B	206
• Signal Engineering & Mig. Co	208
Silvray Lighting, Inc	142
Silvray Lighting, Inc Simplex Wire & Cable Co	143
Smithcraft Lighting Division	144
Sola Flectric Co	168
Sola Electric Co Sorgel Elec. Company	56
Spang-Chalfant (Div. of the National Supply Co.) Spero Electric Corp., The Sprague Electric Co. Square D Co Third Cover, 41, Standard Transformer Co. Steber Manufacturing Co.	145
National Supply Co.)	145
Spero Electric Corp., The	244
Sperti Faraday, Inc	147
Sprague Electric Co	249
Square D Co Third Cover, 41,	146
Standard Transformer Co	216
Steber Manufacturing Co	148
Steel City Electric Co	149
Steel & Tubes Division150,	151
Sterling Electric Motors	227
Sylvania Electric Products, Inc	18
Tal Bender, Inc	222
Templeton, Kenly & Co Thiel Tool and Engineering Co	153
• Thiel Tool and Engineering Co	248
Thomas & Betts Co., The	154
Thor Power Tool Co	156
Thor Power Tool Co Thread-Ezy Mfg. Co	210
Tilden Tool Mfg. Co Tomic Sales & Engineering Co., Inc.	152
Tomic Sales & Engineering Co. Inc.	157
• Triangle Conduit & Cable Co., Inc	155
United States Electrical Motors	188
• United States Rubber Co	158
Velocity Power Tool Co	55
• Wadsworth Electric Mfg. Co., Inc.,	214
Wagner Electric Corp	218
Wagner Electric Corp	159
Wakefield Brass Co. F. W. The	160
Western Insulated Wire Co	192
Westinghouse Elec Corp.	174
(Lighting Div.)	44
(Lighting Div.)	
• Westinghouse Elec. Supply Co	220
Weston Electrical Instrument Corp	164
Wheeler Reflector Co	163
Wheeler Reflector Co. Where To Buy	250
Wincharger Corporation	17
Wiremold Co., The	162
Worner Electronic Devices	246
Youngstown Sheet & Tube Co., The	165
Toungstown Succe & Tube Co., The	102
SEARCHLIGHT SECTION	
(Classified Advertising)	
H. E. Hilty, Mgr.	
EDUCATIONAL	
Books	251
BUSINESS OPPORTUNITIES	251
EQUIPMENT	
(Head or Surplus Now)	
(Used or Surplus New)	255
For Sale	45)
WANTED	
Equipment	25



These manufacturers advertised their products in the ELECTRICAL PRODUCTS GUIDE

For more complete information, and application data on their lines, refer to the Index of Advertisers in the ELECTRICAL PRODUCTS GUIDE . . . the 13th issue of ELECTRICAL CONSTRUCTION AND MAINTENANCE.



Only Square D Balanced Design Gives <u>ALL</u> the Features without sacrificing <u>Any One!</u>

EASY INSTALLATION. Plenty of wiring space with no sacrifice of compactness.

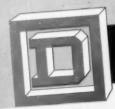
SIMPLE MAINTENANCE. Coils, contacts, interlocks, overload relays easily changed without disturbing external connections. Normal maintenance made still easier with standardized parts kits. No complicated identification, ordering or stocking.

FLEXIBILITY. A wide range of special requirements can be met in the field, using standard starters and parts kits available from local distributor stock.

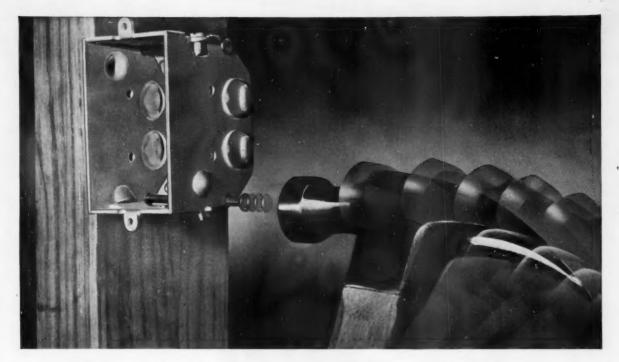
THEY COST NO MORE . . . WHY SETTLE FOR LESS?







SQUARE D COMPANY



How to cut roughing-in time with G-E Levelock boxes



1. Rest the General Electric Levelock* box against the studding. Four leveling projections hold the box straight and steady. (Cable clamp screws are now angled out of the way to permit backmounting, too.)



2. Drive in two nails-and the box is securely mounted. Special nail-through holes let you mount Levelock boxes without disassembling them. Yet the boxes can be disassembled easily for ganging.



3. Levelock boxes are also available with plaster mounting ears adjustable for varying wall thicknesses. Singlescrew attachment and 1/8-inch guide marks make this adjustment quick and accurate.



4. Exclusive locking design keeps side plates tightly wedged in position. Levelock boxes won't loosen when carpenters scribe cutouts.

Save time on your next wiring job by using G-E Levelock device boxes. Your G-E Construction Materials distributor can supply you with 21 different types to meet every wiring problem. For more information write Section C-41A-418, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*Registered Trade-mark General Electric Company

You can put your confidence in_

GENERAL ELECTRIC

